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1922 Ends with Good Promise for Early 1923

Production Increased 70 Per Cent Over 1921, in Spite of Coal Strike and Transportation Troubles—Prices Rose, but High Costs Left Little Profit and Often Loss

A REVIEW of 1922 in the iron and steel industry is valuable in part as history, but more valuable for the light it throws on the yet unexplored region of 1923. In 1921 steel output was the smallest on record in proportion to capacity, and as prices steadily declined consumers used up their stocks to the last ton to avoid going to the mills. In 1922 the effort of the country to restock in steel was naturally a factor, and at the end of the year it would be worth knowing to what extent jobbers' and consumers' stocks have been rebuilt. The question has a bearing on demand in 1923. Railroad buying and new construction were the main props of the steel market in 1922. It is natural to ask at the beginning of the new year whether they will make an equal call upon the industry in the next twelve months.

Automobile builders made a new output record in 1922. Will that of 1923 be greater or less? Farmer buying of implements and of machinery into which iron and steel enter was much below the average in 1921 and 1922. Will there not be a compensating increase in agricultural demand for iron and steel in 1923? Shipbuilding has required comparatively little steel in the past two years. Is there encouragement for a larger rate of shipbuilding in 1923?

Comment will be made later on some of these phases of the outlook. They are mentioned here to emphasize their relation to what happened in 1922, also to suggest that the history of the year just ended illustrates again how developments in iron and steel are influenced in a large way by what occurs outside the industry, important as the industry is in itself, and much as it has been called the barometer of trade.

First and last the coal strike and the railroad shopmen's strike were responsible for a good deal. They had much to do with the course of prices. These strikes and the advance in coal prices that resulted pushed up iron and steel production costs, led to premium prices for prompt delivery steel, limited output of merchant pig iron, led to the bringing in of over 300,000 tons of foreign pig iron, and for a time caused such congestion of rolled steel at mills as threatened the continuous operation of consuming industries.

Great Increase in Output

In spite of its heavy handicaps, 1922 brought marked improvement in the volume of iron and steel business. December, traditionally the month of holiday slowing down, made the high production record of the year, and 1923 opens under a momentum promising a good rate of activity through the first quarter at least.

While the prophecies made as 1922 opened were generally hopeful, none of the leaders in the industry dared predict a demand on any such scale as the year developed. After going through the

Features of 1922

IT was a year of wide swings in production and prices. As low as 1.30c. *for plates and as high as* 2.50c. *Steel work operations ranged from* 35 *per cent of capacity in January to* 80 *per cent in December, with many fluctuations between.*

A coal strike lasting five months, making fuel scarce and high-priced, dominated the pig iron and steel markets for most of the year. Premium prices for finished steel resulted, but costs rose more than average prices.

Railroad buying was far beyond anything expected as 1922 *opened,* 170,000 *freight cars being ordered against* 23,346 *in* 1921. *New construction was another main factor, as was also replenishment of stocks.*

Steel works produced about 33,500,000 *tons of ingots against* 19,783,000 *tons in* 1921, *an increase of* 70 *per cent. In terms of the country's capacity,* 1922 *was thus a* 64 *per cent year, while* 1921 *was a* 38 *per cent year.*

Pig iron production was about 26,800,000 *tons, against* 16,688,000 *tons in* 1921, *an increase of* 60 *per cent. The number of active blast furnaces doubled—*125 *on Jan.* 1, 1922, *and over* 250 *on Jan.* 1, 1923.

deep depression of 1921, few had the courage to expect more than that at some time in 1922 production might get up to 60 or 65 per cent of capacity. Now that the record is made, it is seen that actually the latter figure was almost reached as the average for the year. Speaking in terms of steel ingot capacity, 1922 was a 64 per cent year, whereas 1921 was a 38 per cent year—an estimated steel ingot output last year of 33,500,000 tons, against 19,783,000 tons in 1921.

The Factor of Replenishment

In 1921 the amazing thing was the way in which consumers got along without going to the mills. The country never went through a year before on a 38 per cent operation of steel works, and would not then but for an almost miserly using up of every pound of the steel that figured in the disastrous inventories of Dec. 31, 1920. With prices steadily falling in 1921, buyers kept close to shore. When it appeared that steel prices had been reduced from the war level much more than those of other commodities, the effort of some large producers to get backlogs in plates, shapes and bars in February and March of last year found buyers willing to add to their stocks. What the movement would have gone to but for the coal strike will never be known. With the strike and later the going out of railroad shopmen, the scarcity factor came in and remained until nearly the end of the year. Jobbers succeeded fairly well, in spite of the coal and railroad strikes, in rebuilding their stocks after the drastic liquidation of 1921. But manufacturing consumers of steel often ran on short rations. In the last two months of the year the high rate of steel works operation, which for several weeks was close to 80 per cent of the country's capacity, gave some manufacturing buyers more finished steel than they were currently consuming, but in general inventories of consumers were not large. Reports from jobbing interests are that they sold more steel in the last two months of the year than they expected and therefore are not carrying large stocks over into the new year.

Demand and Prices

The greatest volume of construction work ever completed in a year is a large factor in the record of steel consumption in 1922. The F. W. Dodge Co. estimates put the total value of buildings erected at $4,300,000,000, as against $3,142,000,000 in 1921. The number of buildings of all types contracted for is put at 100,000.

Railroads bought on an increasing scale throughout the year, the outstanding fact being in all the fluctuations in iron and steel output, that the transportation facilities of the country are inadequate and will continue to be a check upon industry. Any shortages in delivery of steel last year were due, not to insufficient supplies but rather to insufficient motive power and freight cars. In what is more fully set forth elsewhere as to the railroad buying of the year, orders for a total of 170,000 freight cars and for not far from 2300 locomotives are outstanding features.

The record consumption of steel in automobile building is one of the familiar facts of the year; equally familiar is the lack of agricultural buying power, which made the operations of implement and harvesting machinery plants much less than 50 per cent of what would ordinarily be expected. Low prices for oil over much of the year held back oil well drilling, so that the principal activity in pipe was in butt weld sizes, finding chief outlet in new construction. At the same time the disposition of oil producers to store rather than sell their product at low prices caused an unusual amount of oil storage tank building. Plate mills had a good year, with all the locomotive car and tank building, so that the lack of shipbuilding was not felt. The trouble was, however, that plate mill building was overdone in war time and there was not enough business for all. Sheet and tin plate demand was more than fair throughout the year, automobile plants and the canning industry being large factors. It was a good year for wire products, apart from agricultural uses, and for nails in particular, in view of the building boom.

The course of prices in the year is indicated fully in the statistical charts and price tables found elsewhere. High-priced coal made havoc of costs at some stages of the strike. In some cases $6 a ton, or $4 more than had been paid for coal from nearby mines, was paid for Kentucky coal, representing nearly $10 increase in the cost of a ton of steel. As against 1.30c. to 1.40c. paid for plates, shapes and bars in February, March and early April, prices later rose to 2c. to 2.50c. Late in the year the premiums came off and the mills aimed at a 2c. market for the three heavy products, though 1.95c. and 1.90c. were done. Much of the car steel of the year was bought at 1.30c. to 1.40c., and it is probable that the bulk of the year's shipments of plates, shapes and bars from leading mills averaged not more than 1.50c.

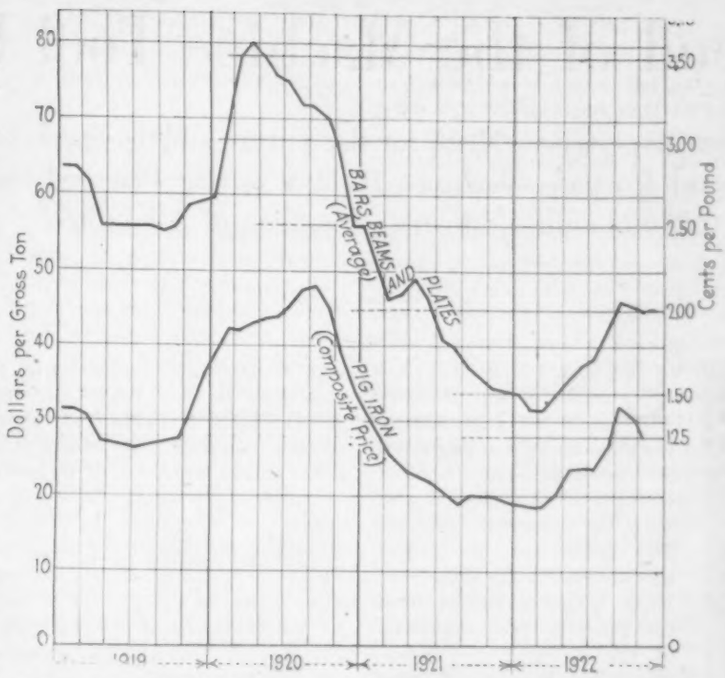
The Coal and Railroad Strikes

Prior to the strike of the union workers in the country's bituminous coal mines on April 1, iron and steel producers were generally confident of their ability to keep up operations on a scale sufficient to meet all demands upon them. The steel industry as a whole was running at that time at about 65 per cent of capacity. Buying in March had been at a greater rate than at any time since July or August, 1920. Reserves of soft coal were put at about 63,000,000 tons, or roughly about two months' requirements for the country. Non-union mines, which it was then believed would not be affected greatly, were producing about 5,000,000 tons a week. The strike was not expected to last long. The miners' demand for the $7.50 wage of the post-war boom, or more than they had in war time, was unpopular and was not believed to be enforceable, particularly as they were not thought to be financially able to maintain a long strike.

As the strike went on, the earlier reckonings required to be revised. The steel companies in fact did keep up their production well, thanks to the coal stocks they had laid up. But the belief that non-union miners would not go out proved illusory. Few steel companies, the Steel Corporation included, which depend on the Connellsville district for coal, were prepared for what happened there. Within two weeks the stoppage of mining in non-union fields had gone to the point of causing the banking of a number of blast furnaces in Ohio and the Pittsburgh district, and plans that had been announced for the starting of other furnaces were held in abeyance. The steel companies made large purchases of coal in the West Virginia and Kentucky fields, the Steel Corporation being particularly forehanded in getting a good share of the available coal from those districts. The increase in fuel cost per ton of steel was heavy, but the maintenance of steel output was counting strongly in the breaking of the strike.

The hopes of the strikers were near the lowest when the suggestion came from the President that

the miners go back to work at the wages for which they were fighting, pending an investigation and report by a committee. The miners flatly rejected arbitration, and there was a division among the operators over the President's plan. The strike went on and ended late in August in a complete victory for the union. At the same time advances of 40 per cent and more were made at non-union mines. These latter advances, however, did not bring full resumption in the Connellsville district, many of the miners there continuing to hold out for recognition of the union, which operators there have steadily refused.



Curves Showing Fluctuations in the Average of Bar, Beam and Plate Prices, Pittsburgh, in 1919, 1920, 1921 and 1922, and for the Same Years the Fluctuations in the Pig Iron Composite (Basic Iron at Valley Furnace and Foundry No. 2 at Chicago, Philadelphia and Birmingham)

A strike of railroad shopmen on July 1 against findings of the Railroad Labor Board and against the policies of various railroads in enforcing shop rules aggravated the effect of the coal strike upon iron and steel works operations. By a strange twist of fate the roads over which coal was moving from Kentucky and West Virginia fields to help out the steel companies were the first to feel the shopmen's strike, and congestion quickly ensued. The worst situation was reached in the second half of August, when steel output went below 50 per cent of capacity. A sweeping order of the Interstate Commerce Commission, effective July 25, establishing priorities in all railroad traffic and in fuel distribution, imposed a new handicap on iron and steel companies, and its cramping effect on the output continued for a month or more. The ending of the coal strike late in August was the turning point. Fuel supply slowly increased in the first half of September and more rapidly in the second half, and eventually an 80 per cent steel output was reached. That is apparently the limit now possible, with present transportation facilities and the present restricted supply of common labor.

Production

Considering all the handicaps under which blast furances and steel works labored, the output of the year represents a remarkable recovery from the depression of 1921. We estimate pig iron production (apart from charcoal iron) at 26,800,000 tons. Steel ingot production may be estimated at 33,500,000 tons and steel castings at 850,000 tons, making the total of ingots and castings about 34,350,000 tons. Comparison with the six previous years is made in the following table:

	Pig Iron, Gross Tons	Steel Ingots and Castings, Gross Tons
1916	39,434,797	42,773,630
1917	38,621,216	45,060,607
1918	39,054,644	44,462,432
1919	31,015,364	34,671,232
1920	36,925,987	42,132,934
1921	16,688,126	19,783,797
1922	26,800,000*	34,350,000*

*Estimated.

The variations in pig iron production appear in the following statement of the number and daily capacity of the furnaces in blast at the beginning of each month:

1922	No. in Blast	Daily Capacity, Gross Tons	1922	No. in Blast	Daily Capacity, Gross Tons
Jan. 1	125	53,735	July 1	192	81,845
Feb. 1	126	53,305	Aug. 1	172	70,605
Mar. 1	138	59,030	Sept. 1	144	54,645
April 1	155	69,015	Oct. 1	189	77,005
May 1	162	72,875	Nov. 1	218	87,935
June 1	175	77,520	Dec. 1	242	97,135

(*Continued on page* 51)

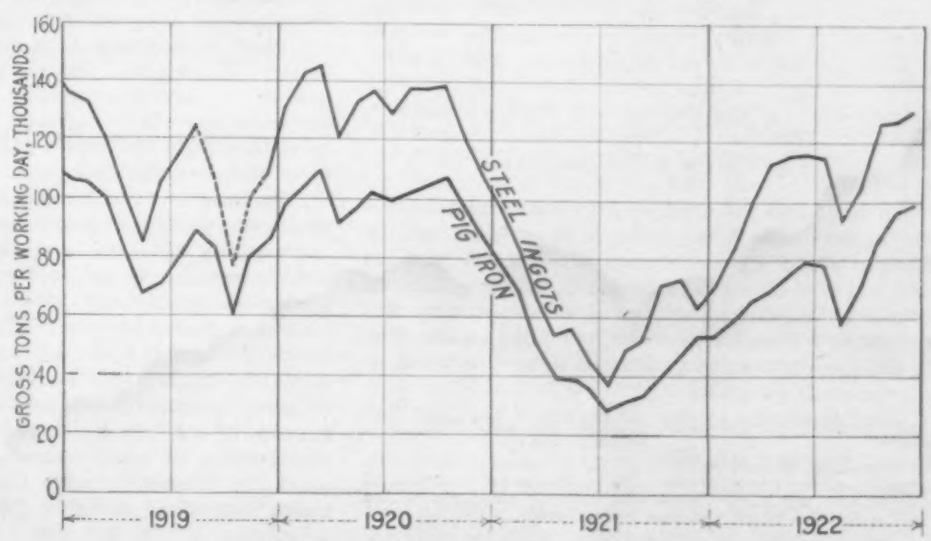


Diagram Showing the Fluctuations in Daily Average Production of Steel Ingots and Pig Iron in the Past Four Years. Based on monthly ingot statistics of American Iron and Steel Institute and monthly pig iron statistics of THE IRON AGE. The dotted ingot line in late 1919 is for the period of the steel strike, when statistics were not reported

The Trend of the Machine Tool Industry

What Recent Experiences Mean for the Future—More Specialization, Yet General Purpose Machines Hold a Strong Place—Relation to Automobile Industry—Problem of Alloy Steels

BY FRANK A. SCOTT*

FRANK A. SCOTT

EXAMINING the machine tool industry at the close of 1922 reveals many interesting facts and develops some questions which will be answered only with the progress of time. The great war, so largely mechanical in its character, made immense drafts upon the machine tool industries of the warring nations. Those countries which were machine tool producers at the beginning of the war expanded their facilities to the very limits of their power. Those not possessed of machine tool industries established them and made some progress in production. The cessation of the war demand not only rendered idle the great productive facilities which had been supplying it, but at the same time there poured from thousands of government and privately-owned munitions plants such a volume of second-hand tools as the world had never seen before. Therefore, in every country the machine tool industry has been struggling against the meager demand consequent upon an industrial depression, and the necessity for absorbing and reallocating the used tools released from war work.

Made Stronger by Adversity

At the end of 1922 it is possible to say that, after two years of the worst depression in its history, the industry not only has survived but has been strengthened. It is true that some of the weaker organizations and some that were the offspring of the war demand have fallen out. It is also true that many of the older and stronger concerns have met the financial strains of the post-war period by refinancing operations. Out of it all there emerges a machine tool industry vastly more experienced in quantity production, in meeting new engineering problems, in utilizing unskilled labor, in working metals but little used prior to the war, in supplying foreign demands and dealing with foreign customers.

Less Than a 40 Per Cent Year

In no part of the world was there a normal demand for machine tools during 1922. It is probable that the business of American manufacturers did not reach 40 per cent of their producing capacity. Substantially all of this modest demand originated in this country. The volume of foreign business, while a little greater than in 1921, was still so small as to be without influence on the American program.

Most prominent among the causes of the light foreign demand are the uncertain political and financial conditions in those countries, strikes, the vast volume of used tools available from unnumbered sources, and, on the Continent, the competition of new and good lower priced machines of German make, mostly copies of American designs. However, as one American observer of conditions in Europe phrased it, "The European metal-working industry is stumbling along." Progress is being made; consumption continues, and production can not forever be deferred. Herein would lie the advantage to the American machine tool manufacturer of American participation in European financial rehabilitation.

Prices Tend Upward

The price trend of machine tools is now clearly upward. During 1921 and 1922 there was uncertainty caused by poor business, large inventories, and confident anticipations by the American producer that his material and labor costs would be lower. It is every day becoming more evident that anticipated reductions in these items are unrealized, and therefore the last quarter of 1922 has shown a steady advance in list prices of machine tools.

The supply of finished machines in the hands of makers undoubtedly remained at about the same point throughout the year. While it is true that there has been production in somewhat increased volume over 1921, the sales volume has been so low as to result in little more than a general inventory reduction.

Specialization More Marked

American-made machine tools cover the entire field: simple forms which have few power and automatic movements and are adaptable to any operation within the group for which they are designed; highly specialized and automatically operated single-purpose machines intended for certain operations upon particular pieces; and highly developed automatic machines, flexible in their productive elements. For many years it was important, but not essential, that the machine tool manufacturer determine definitely the exact character and range of work which he proposed to cover by his design. The machine was so flexible that it could be used in any metal-working field, and its flexibility usually could be made even greater by a tooling equipment specially designed to meet a particular purpose. Gradually this condition changed toward specialization.

The trend of American metal-working has been toward concentration in larger units, with great productive capacity and continuous work upon fixed designs. Small arms, the sewing machine, and the bicycle were among the early products which lent themselves to this kind of a producing plant. Plumbing supplies, many forms of electrical equipment, and other lines of manufacture which were well developed at least 25 years ago all gave opportunity for specialized machinery. The automotive industry, however, is the one which forced consideration of specialization in metal-working and which has given opportunity for the finest accomplishments in the field of highly specialized automatic ma-

*President Warner & Swasey Co., Cleveland. Mr. Scott's conspicuous war-time service at Washington as chairman of the General Munitions Board and later as chairman of the War Industries Board are well remembered.

chinery for the rapid production of duplicate parts accurately machined.

Three Main Groups of Users

Therefore, American users of machine tools might now roughly be grouped into three classes:

First, the manufacturers whose goods require large quantities of duplicate parts, or continuous production of duplicate parts with no changes in design. In this class would be included a few of the larger automobile plants, some producers of electrical equipment, some screw and bolt plants, the larger producers of plumbing supplies, etc.

Second, the manufacturers whose goods require the production of parts in considerable number, but insufficient to justify a continuous run for more than perhaps a few days or weeks, this interruption necessarily involving changes in machine set-ups. Into this class would be put most of our automobile plants, producers of locomotives, substantially all the machine tool manufacturers, agricultural machinery manufacturers, machine shops at the great shipbuilding and navy yards, etc.—probably the bulk of American metal-working industry.

Third, the general machine shops which encounter frequent interruptions in their work and the necessity for constant changes in set-ups of machines, including perhaps in this class most of the railroad repair shops, most tool rooms of the larger plants, some of the machine tool builders, and all the general machine shops and repair shops of the country.

The Designer's Problem

It is clear that to serve these three classes of producers and metal-workers to the best advantage it is necessary for the American machine tool manufacturer to develop a product that will be either sufficiently universal to be adaptable to the three phases of metal-working outlined above, or will be so altered in character as to be especially applicable to one or more of these classes.

The machine tool industry has built its engineering advances upon the solid foundation of experience. Neither the industry nor its customers have been involved in the losses which are the product of enthusiasm untempered by knowledge. Acknowledging this, and acknowledging also that automatic machines are at times a costly experiment, what shall the machine tool designer do?

The answer to this question concerns the machine tool users even more than the makers. The success of American metal-working depends absolutely on American machine tool efficiency. The solution rests in the possibility of cooperation between the great users and the producers of these necessary equipments. The greatest users the world has ever seen are the automobile manufacturers.

Relation to Automobile Development

The automotive business of the United States has become the miracle industry of the world, and by its recognition of the power of quantity production enjoys world supremacy for its product. This success was possible only with the co-operation of the machine tool industry of the United States. By its ready recognition of the problems and its prompt response to the new demands and opportunities presented by the American automotive manufacturers and by supplying the latter from groups of apprentices a never failing source of highly trained mechanics, the machine tool industry played its part.

Conversely, it must be acknowledged that the courage, resourcefulness and initiative shown by the engineers, capitalists and inventors in the automotive field, stimulated those similarly related to the machine tool industry, so that the latter have made greater strides in the 10 years just past than in the 20 years preceding. Design and material both have been affected by the demands and examples originating from the automotive manufacturers. Their experimental laboratories have developed much that benefited the machine tool industry as though intended especially for it. In compensation for his contributions, the automotive manufacturer has been the beneficiary of special engineering work freely bestowed by the machine tool manufacturer. To study a design with the view to developing a special machine, or a tool equipment, to lessen the cost of a particular part has become one of the every-day commonplaces with the American machine tool engineer.

Perhaps there is a feeling in the machine tool industry that these contributions made by it to the automotive industry have been taken too much for granted, and that they have been accepted too much as an element of the sales activity in the machine tool business, rather than as a professional service. There is much to evidence an increasing self-consciousness in the machine tool industry, and the probability that professional services are more likely hereafter to be increasingly so classified. If this should develop to be the case, we would then see drawing to its close that era in the machine tool business during which it has been possible for a prospective customer to enjoy the best engineering and laboratory talent of the machine tool manufacturer, as applied exclusively to his own product, with no obligation except the possible purchase of a few machines, at the going market price, when the studies had been completed.

The new era of price competition in the automotive industry again brings the machine tool manufacturer into prominence. For a few years it appeared that the machine tool work in the automotive field had reached the topmost point of its ability to render service. The automotive industry seemed to be at the very peak of productivity in quantity, at low cost. The conclusion then would have been that the automotive man had passed the period of greatest need for the co-operation of his machine tool brother. The depression of the past two years has entirely changed this picture. The price competition in the automotive industry has again made essential to its welfare the utmost that can be done for it by the machine tool designer in the development of equipments that will produce quantity, good workmanship and low cost.

New Calls Upon the Machine Tool Manufacturer

At the very moment, however, that this new need has arisen in the automotive industry, the machine tool producer is being beckoned into other fields by new customers, such as the manufacturers of electrical equipment and the many household appliances and conveniences that have suddenly begun to flood the market. The railroads also have called upon the machine tool man for help in the much needed rehabilitation of the railroad shops to bring them up to a basis of modern efficiency. However, it is clear that the greatest metal-working industry which the world has ever seen must continue to receive the best help that can be extended to it by the American machine tool manufacturer. Fortunately, from the automotive field comes recognition of the desirability of this help. Some of the best points that have been made in relation to the mutual dependence of these two great industries are to be found in the addresses made by automotive engineers at their meeting in Detroit in October, 1922.

New Importance of Apprenticeship System

Mention has been made of the contributions of skilled men by the machine tool industry to the automotive industry. This brings forward for examination the apprenticeship system which has been followed for over half a century in the machine tool business. Young men who have had four years special training in ma-

chine tool plants, this training in many instances including theoretical mechanics as well as practical work on all types of productive machinery, graduate not only as skilled mechanics, but with minds trained to appreciate the value of high standards in metal-working and the methods by which high standards may be attained. The quality of machine tools and of other metal products as well rests upon this. A canvass of any organization of superintendents and foremen in any of our great metal-working centers is rather astonishing in the numbers of machine tool apprentices who are shown to have reached eminence in other metal-working lines. At the meeting of automotive engineers referred to above, very frank recognition was made of this tremendous contribution by the machine tool industry to the automotive industry, and emphasis was laid upon the necessity for the latter industry now developing its own apprentice courses.

Machines for Working on Alloy Steels

Accompanying the demand for single-purpose machines of automatic type, arising out of the new era of price competition and the high cost and scarcity of skilled and semi-skilled metal workers, have come new problems presented by the use of materials containing alloys, the use of alloy steel for cutting tools, and the use of other special cutting materials which admit of deeper cuts and faster speeds than those for which most machine tools were originally designed. It is natural that machine tool design must follow and cannot precede the working up of alloy steels with the newer alloy cutters. The new alloys must first be developed and the market for them created before the machine tool manufacturer can visualize a machine to work up these alloys most efficiently. Very few machine tools on the market today will work up materials to the capacity of the cutters. It is true that in experimental work the cutters can be made to give way first, but in most instances the trouble can be located in the machine; vibration between the work and the cutters causes more cutters to break down than the action of the metal against the cutter. It is evident that this problem could be met more readily in a single-purpose machine than in one of more general design; but again the advantage thus attained is somewhat neutralized by the loss of flexibility in the use of the machine. The designing of machine tools, like the designing of a warship, necessarily is a compromise, and an effort to balance advantages against weaknesses or disadvantages. These points are mentioned only to emphasize the necessity for the machine tool manufacturer clearly electing the field which he proposes to cover.

Special Machines and General Purpose Machines

It is not the purpose of this article to endeavor to establish the course of action for the American machine tool manufacturer. Even superficial examination of the field, however, indicates a trend toward quantity production that immediately suggests automatic machinery and single-purpose machines specially designed for particular uses. One might be inclined to conclude, therefore, that these two types of machines are the ones which hold the key to the future of metal-working in our country. But this conclusion would immediately be weakened by the fact that from the engineers of the very industry which has called most insistently for these types of machines, even so recently as October last, comes the suggestion that this demand should now be modified. Perhaps the best discussion of this particular phase of the problem which thus far has been presented for consideration by American manufacturers is to be found in the proceedings of the meeting of the automotive engineers in Detroit, heretofore referred to. Its solution will rest in following the Scriptural admonition, "This ought ye to have done, and not to have left the other undone." It is entirely probable that we shall witness a development of special machinery and at the same time an improvement in the design of general purpose machines; and it is altogether more than probable that, well beyond the life-time of the men now engaged in the industry, standard machines of the so-called general type will continue to be the backbone of all machine shop installations.

A High Place in Industry

A survey of the machine tool industry opens a fascinating and inspiring field of study. It might be divided into sections, and so studied from the economic view, or its relationship to industrial progress; from the point of view of the engineer, or its place in the development of the mechanic arts; from the banker's outlook, or its influence on trade, commerce and finance; from the standpoint of the philosopher, or its effect on civilization and the progress of man. In any case, it is obvious to the most casual that modern civilization would be impossible without the services of the "iron man," and that, like most good servants, the machine tool industry has performed its service quietly and with a self-effacing competence that might easily result in being overlooked or discounted unreasonably.

Little Luxemburg's Big Steel Industry

Immediately previous to the World War, Luxemburg was the fifth largest iron producing country of the world, but the war led to a sharp decline in this output while political changes effected by the treaty of Versailles entailed a complete reorganization of the industry by the transfer of ownership of many of its plants, the regrouping of allied, and the adjustment of opposing interests, and by bringing about conditions which have forced the industry to seek new markets and adjust its business to entirely new conditions.

The Grand Duchy has not yet reached its pre-war production either in mines or mills, but the fact that its furnaces and steel mills increased their output in 1921 over 1920 by nearly 50 per cent and that the output in 1922 shows a much larger increase indicates that the industry has regained its vitality and that its position in the iron and steel world merits the careful attention of all possible competitors, says Consul General George E. Anderson, Rotterdam, in a report to the Department of Commerce. This impression is deepened by the fact that Luxemburg is now exporting its ferrous products all over the world and is rapidly establishing the output of its factories in countries where its products have never before been known. On an average something like nine-tenths of the iron and steel products of Luxemburg are exported. Two of the principal companies have formed a selling company to which they have conceded a monopoly of the sales of their products while a third company is partly owned by the sales company. This organization in the past few months has completed agency arrangements over nearly the whole of the principal iron and steel consuming countries of the world. Sales to Germany and Austria have declined, but the purchases of Belgium, Holland, and Great Britain have increased materially. The chief development of the trade is through connections recently made in Brazil and the Argentine, the East Indies, Japan, and China.

Variety of Electric Brass Furnaces

Not less than 80 different types or different makes of the same type of electric furnaces have been used, tried or suggested for melting copper, brass or bronze, aluminum or nickel alloys. Descriptions of these different types of furnaces are contained in Bulletin No. 202, just issued by the Bureau of Mines.

The American Industrial Furnace Corporation, 10 Post Office Square, Boston, has moved to 422-428 Unity Building, 185 Devonshire Street, that city.

Present Adjustment and Trend of Wages

Analysis of Railroad, Manufacturing and Coal-Mining Wages, Cost of Living and Wholesale Prices—Wage Trends Ever Upward

BY CHARLES M. MILLS

THE crux of the present industrial situation lies in equitable adjustment of wages in a period of general deflation. The question of collective agreements, working conditions, hours, and even seniority, while seeming to many as the most important feature of the present industrial crisis, are all, in reality, subordinate to the wage problem. If one has read the industrial news carefully for past months, he has seen that the wage issue has predominated. The United States Railroad Labor Board reduced the wages of railroad shopmen to levels showing net increases ranging from 39 to 78 per cent over 1917 levels, and the most disastrous shop strike of recent years resulted. The maintenance of way men, upon the very heels of the recent curtailment of their rates by the Railroad Board, petitioned for new increases ranging up to 100 per cent.

The bituminous coal strike ended by means of the Cleveland agreement, which maintains the war-time rates of the last collective contract until April, 1923, and adds presumably a billion extra dollars to the coal bill of the public. The non-union operators accordingly announced 40 per cent wage increases in their collieries. The anthracite coal strike terminated by carrying over war-time rates until Sept. 1, 1923. The textile strike in New England was settled by a continuation of the rate of wages paid in March, 1922. The United States Steel Corporation and prominent independent steel companies recently announced a 20 per cent increase in wages. The wage question, therefore, more than ever before, lies at the heart of the industrial world.

The average member of the largest but entirely unrepresented group involved—the public—is completely bewildered. What are the facts? Has the period of wage and price deflation ended? Have we entered a new period of inflation and, if so, what are the causes? Are the reactionary forces in capital and the radical groups in labor forcing an artificial economic issue upon the entire nation?

Price Deflation

An analysis of the official governmental figures covering wholesale and retail prices in the United States throws considerable light upon the situation.* The peak of wholesale prices was reached in May, 1920, when the index number stood at 247, or 147 per cent above 1913. A steady decline occurred from the peak down through January, 1922, when the index stood at 138, or 38 per cent above 1913. The total decline, therefore, from the peak to the end of the decline in January amounted to 44.1 per cent. Since January there have been a steady increase in wholesale prices, expressed in index numbers as follows:

February	141
March	142
April	143
May	148
June	150
July	155
August	155
September	154
October	156

In other words, the period of wholesale price deflation ended in January last, with a total decline of over 44 per cent from the peak, while steady increases have occurred since the beginning of 1922.

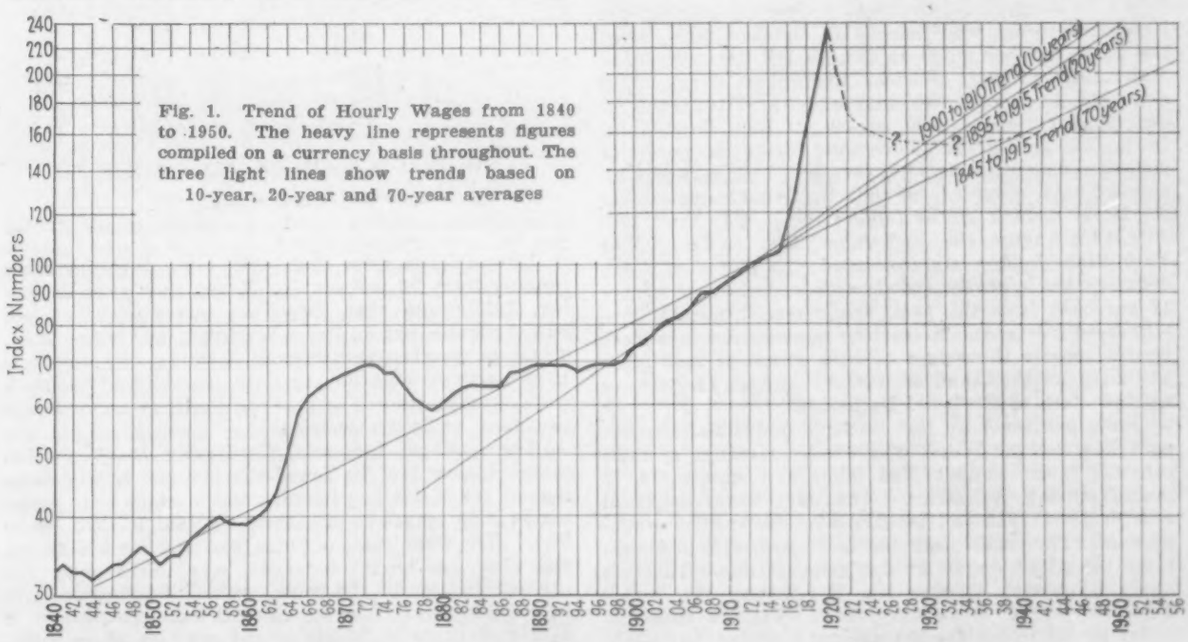


Fig. 1. Trend of Hourly Wages from 1840 to 1950. The heavy line represents figures compiled on a currency basis throughout. The three light lines show trends based on 10-year, 20-year and 70-year averages

Cost of Living

The peak of retail food prices as determined by the Bureau of Labor Statistics was reached in June and July, 1920, when the index number stood at 221, or 121 per cent over July, 1914. A steady decline occurred down through May, 1922, when the index number stood at 140, or 40 per cent above 1914. The total decline, therefore, from the peak to May, 1922, amounted to 36.6 per cent. Since May the index numbers of retail food prices have been as follows:

June	141
July	142
August	141
September	140
October	143
November	145

We may conclude, therefore, that so far as wholesale

*Bureau of Labor Statistics, Washington: Wholesale Prices; Retail Food Prices.

prices and retail food prices are concerned, the period of deflation temporarily ended during the first half of 1922, and that at present we are in the midst of a period of rising prices.

The peak of the national cost of living, as determined by the Bureau of Labor Statistics, occurred in June, 1920, when the index number stood at 216.5, or 116.5 per cent above 1913. By September, 1922, the index number had fallen to 166.3, or 66.3 per cent above the pre-war level. The total decline was slightly over 23 per cent.

In passing, it is interesting to note that while wholesale prices declined over 44 per cent and retail prices over 36 per cent, the cost of living has declined only a little over 23 per cent, and that the latter is practically stabilized in response to higher prices. So far as prices and the cost of living are concerned, we have definitely ended the period of deflation and have entered upon a new era of higher levels.

Wage Deflation

Available sources covering wage deflation are exceedingly limited, as most data are given for specific periods only, and do not cover trends from the same sources over a period of years. The best sources for wage information dating from 1914 are the trends covering 1648 New York State firms gathered by the New York Department of Labor and the reports of the National Industrial Conference Board.

Data covering New York firms include only weekly earnings of both male and female workers combined. Based on June, 1914, the peak of weekly earnings in New York State was reached in October, 1920, when the index number stood at 228, or 128 per cent above June, 1914. Steady declines took place during 1920 and 1921, so that in February and April, 1922, the index number stood at 190, or 90 per cent above June, 1914. The percentage of decrease during the period of deflation amounted to 16.7 per cent. Since April increases have occurred, so that the index numbers for the latest months are as follows: May, 194; June, 196; July, 195; August, 198; September, 202. So far as New York State figures are concerned, the period of wage deflation has recently ended, with a decline of almost 17 per cent from the peak, while recent months have witnessed increases. It must be remembered that these figures include the wages of both sexes, of both office and shop workers, and of workers in such large cities as New York, Buffalo and Rochester.

Data published by the National Industrial Conference Board cover hourly and weekly earnings of male common labor, male skilled labor and women, in 26 manufacturing industries. The data cover identical sources from 1914 and include over one million wage-earners. The reports are the most authentic and complete record of wages at the present time. The last study (Research Report No. 52) covers the period from July, 1914, to January, 1922. Figures from the latter period to the present are not included, but would unquestionably show status quo levels or slight increases.

The peak of hourly earnings was reached in September, 1920, when wages were 156 per cent above July, 1914. The decline up to 1922 amounted to 22.4 per cent, leaving hourly earnings 98 per cent above the 1914 level. The peak of weekly earnings was reached in July, 1920, when wages were 140 per cent above 1914. The decline up to 1922 was 25 per cent, leaving wages 80 per cent above 1914. The last six months of 1921 show practically stationary levels in hourly and weekly wages, and point to the end of deflation.

Résumé of Deflation in Manufacturing Wages

If we may take the above sources as a guide for analysis we may assume that manufacturing wages have declined from 20 to 25 per cent from the peak. The period of decline in wage rates and earnings has come to a close, with rising scales marking the present situation. With these considerations in mind, it is interesting to pass on to railroad and mining industries and examine their wage levels in relation to manufacturing. The conditions of work, hours, training, availability of wage data, etc., in factories, mines and on the railroads, are so variable that direct comparison is impossible, yet there are certain general differences that may be emphasized.

Wages of Railroad Shopmen

The rail strike of shopmen arose as a result of wage reductions ordered by the Railroad Labor Board, effective July 1, 1922. The shopmen struck as a result of their feeling that their wages were inadequate and below a reasonable standard of living. As the original issue over wages has since been overshadowed by the question of seniority, it is worth while to turn to Decision 1036, Docket 1300, of the Railroad Labor Board and note the information carried in Table I.

*Table I.—Comparative Purchasing Power, Earnings Common Laborers and Workers in Shop Crafts at Specified Times**

	Amount of Hourly Rate	Per Cent Increase Over December, 1917	Per Cent Increase in Cost of Living Over December, 1917	Per Cent Increase in Purchasing Power of Earnings
Common Labor:				
December, 1917..	19.3c.	....	....	....
January, 1920..	37.3	95.3	40	39.5
May, 1920..	46.3	139.9	52	57.8
July, 1921..	37.7	95.3	26.7	54.1
Present decision..	32.7	69.4	17.2†	44.5
Shop Crafts, Machinists:				
December, 1917..	50.5c.	....	....	....
January, 1920..	72.3	43.2	40	2.3
May, 1920..	85.3	68.9	52	11.1
July, 1921..	77.3	53.2	26.7	20.8
Present decision..	70.3	39.2	17.2†	18.8
Carmen:				
December, 1917..	37.7c.	....	....	....
January, 1920..	68.0	80.4	40	28.9
May, 1920..	81.0	114.6	52	41.2
July, 1921..	73.0	93.6	26.7	52.8
Present decision..	64.4	70.8	17.2†	45.7

*Reprinted in the Monthly Labor Review, July, 1922, page 95.
†Latest available figure, March, 1922.

It would not seem that, with percentage increases ranging from 39 per cent to 71 per cent over December, 1917 (note that these are increases based not on 1914 levels, but on December, 1917) and with the increase of purchasing power of earnings ranging from 18 per cent to over 45 per cent, the railroad shopmen were unjustly treated or that the Railroad Labor Board had made an unfair decision.

The National Industrial Conference Board, in Research Report No. 52, found the average hourly earnings of 143,274 skilled foundry and machine shop workers in 1353 plants in 42 States on Jan. 1, 1922, to be 56.1c. The wage rates of 70.3c. per hour for machinists and 64.4c. per hour for carmen, established under the present decision of the board, would therefore seem to be considerably above the general national average of skilled workers in foundries and machine shops. Unquestionably there might be instances were local rates would be higher than those established by the board, but the history of recent "farming out" methods employed by the railroads would seem to refute such examples.

By comparison, therefore, with the rates established in 1917 with the national cost of living figures, and with such data as are available covering similar work in shops outside of the railroad shops, the present wage rates of railroad shop workers are at least fair and equitable.

Coal Wages

One of the most salient features of the recent coal strike was the lack of reliable wage data. A multitude of figures were presented by both sides, but the majority of such information was not generally considered satisfactorily representative—the data being generally of a selective nature. At least one factor is evident at present—the recent strike resulted in a continuation of old wage levels—status quo wages being continued until 1923. In comparison with widespread declines in manufacturing wages, and more moderate reductions on the railroads, the coal industry stands to-day on the highly inflated peaks of the war period. Sooner

or later, the coal industry must submit to the inevitable, as no one basic industry can permanently occupy a falsely expanded position in the face of world-wide economic forces.

The paucity of trustworthy information, the seasonal character of the industry, overproduction and overdevelopment make any discussion of wages in the bituminous industry impossible. The public must wait for such material to be gathered by the newly appointed United States Coal Commission.

In the anthracite industry one company, operating 11 collieries and employing over 6300 men, stated that in October, 1921, average hourly earnings of all workers were 70.68c., an increase of 153 per cent over June, 1914.* At this time, the average hourly earnings of all *inside* labor were 75.2c., common labor receiving 61.5c., semi-skilled labor 67.8c., skilled labor 71.38c., and contract miners 88.76c. All *outside* labor received 57.1c., average, divided as follows: common labor 53.65c., semi-skilled labor 57.98c. and skilled labor 66.84c. If we may accept these figures as being fairly representative of the industry, it is then possible to compare the average hourly earnings of the anthracite industry with the railroad shop rates, and with the average hourly earnings in manufacturing from sources previously referred to, by means of the chart. (Fig. 2.)

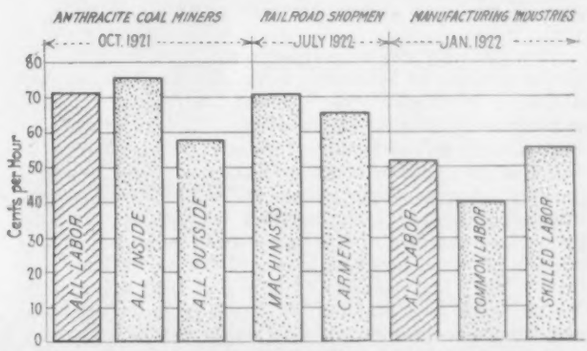


Fig. 2. Comparison of Hourly Wages of Miners, Railroad Shopmen and Factory Workers. The data are from the National Industrial Conference Board and the United States Railroad Labor Board

A study of the diagram shows the overbalanced position of the anthracite industry and the railroad shops in comparison with general manufacturing. Due regard must be paid to the difference in the three industrial groups in the hazards of the industry, training and skill required for the job, the opportunity for work, etc., but even then the inflated character of the hard coal industry and the unduly high position of railroad shop crafts must be acknowledged.

Comparison Between 1914 and Present Wages

During the last few months there has been a great demand to compare wages on a present basis with those existing in 1914 and to obtain the percentage increases from 1914 to the present time. Upon the basis of the appearance of high percentages of increase, wage reductions have been demanded and made frequently. The average man in the street, upon receiving these percentage increases, will naturally say that the industries receiving the largest percentage increases should receive the largest amount of reduction, and those with the least inflation, the least reductions.

If wages have increased 120 per cent in rubber manufacturing and only 75 per cent in the printing trades, the average man will say that wages in rubber factories ought to be reduced before wages in printing plants. But mere percentage increases do not tell the whole story or furnish the argument for wage reductions. In actual dollars the increase in the printing trades may have been above the actual dollar increase in rubber factories. Percentage increases, taken alone, are distinctly misleading, and should never be taken as a sole argument for wage adjustments. Predicated on a 1914 basis, they presuppose the equality of wages in 1914 in all industries. As a matter of fact, wage levels differed as much then as now.

This point is brought out clearly by analyzing the actual wages and percentage increases in hourly and weekly earnings from July, 1914, to January, 1922, presented in 24 principal manufacturing industries, published in Research Report No. 52, National Industrial Conference Board. Table II shows the actual wages and percentage increases in 1914 and 1922.

Table II

Manufacturing Industry	Actual Wage Hourly July, 1914	Actual Wage Hourly Jan., 1922	Actual Wage Weekly July, 1914	Actual Wage Weekly Jan., 1922	Percentage Increases in January, 1922, Over July, 1914 Hourly	Percentage Increases in January, 1922, Over July, 1914 W'kly
Metal Working:						
All industries, foundry and machine shop products	27.5c.	50.8c.	$13.51	$22.87	85	69
Automobiles	29.1	57.2	15.35	25.04	97	63
Agricultural implements	26.2	47.4	13.43	20.93	81	56
Electrical apparatus	27.0	51.0	13.44	22.30	89	66
Iron and steel	26.0	45.6	13.97	23.01	75	65
Textile:						
Cotton (North)	17.1	40.7	8.90	18.59	138	109
Cotton (South)	12.8	28.9	7.27	15.50	126	113
Wool	18.5	45.5	9.77	21.09	146	116
Silk	19.3	42.9	9.88	19.57	122	98
Hosiery and knit goods	17.9	39.0	8.59	17.65	118	105
Miscellaneous:						
Rubber	25.6	53.1	12.75	24.66	107	93
Leather tanning	21.4	44.6	11.24	21.93	108	95
Boots and shoes	21.8	47.9	11.60	22.43	120	93
Meat packing	21.6	44.6	12.07	21.62	106	79
Chemicals	22.6	45.4	12.77	23.49	101	84
Fertilizers	20.6	30.1	11.42	15.78	46	38
Paint and varnish	27.2	51.3	13.96	24.03	89	72
Paper and Printing:						
Paper and wood pulp	22.3	46.0	12.14	24.17	106	99
Paper products	19.2	45.9	9.68	20.34	139	110
Printing (book and job)	30.4	61.5	13.82	29.01	102	110
Printing (newspaper)	41.5	68.7	18.05	31.90	66	77
Lumber and Building Materials:						
Lumber millwork	24.0	48.2	12.77	23.32	101	83
Furniture	22.8	46.9	11.23	22.83	106	103
Brick and tile	23.3	43.2	12.42	22.22	85	79

Looking down the percentage increases in hourly earnings, we see the greatest increase in wool, 146 per cent, the actual gain being 27c. Still larger actual increases in cents, however, occurred in rubber manufacturing (27.5c.) and the printing trades (31.1c. and 27.2c.), although the percentage increases were far less than in the woolen industry. Again, in weekly wages, the largest percentage increase occurred in wool manufacturing, with 116 per cent, the actual gain being $11.32. But larger dollars-and-cents increases were noted in rubber ($11.91), paper and wood pulp ($12.03), the printing trades ($15.19 and $13.85) and furniture ($11.60). The increase in book and job printing plants was the greatest, $15.19, although the percentage increase of 102 per cent was much lower than in the woolen industry.

Adjustment of wages can never be made solely on a basis of percentage increases over 1914. Reasonable and fair wage adjustment must include consideration of the equality of the 1914 wage and the actual dollar-and-cent increases since that time. What was the wage level in 1914? Was it equitable? Did it allow a fair standard of American living? To take percentage increases over 1914 as a standard of adjustment is to accept the erroneous idea that wages in 1914 were absolutely just and that all future wage levels should be established in regard to pre-war conditions. The average wise industrialist will shun the sole use of the percentage increase method as being unfair, unjust and misleading.

The Return to 1914 Wages

During the depression period, there have been certain industrialists who have earnestly believed that wage rates could be forced back to 1914 levels. To these men the ultimate goal—the *summum bonum*—

*National Industrial Conference Board Research Report No. 47, "Wages and Hours in Anthracite Mining," page 65.

is to return to the "good old days" of eight years ago, when labor costs were one to two-thirds lower than today. "If only," they say, "we can put labor back to its proper basis, prosperity will return and we can compete with the Chinese labor rates of a demoralized Europe."

Some of this group have most unfortunately used a period of depression and widespread unemployment to try to carry their theories into action. Working forces have been cut again and again, with rehiring at ever lower and lower levels—a 20 per cent initial cut has been followed by a 15 per cent reduction, and then 10 per cent, and so on, so that in certain localities wages have actually touched 1914 levels, though our official cost of living figures still stands at 66 per cent above the pre-war base. Unfortunately, such men have brought not only upon themselves, but upon the employing forces of the country, severe criticism from other employers and the public, as well as the deeply rooted antagonism of the labor forces.

These gentlemen of the *laissez-faire* school have been in conflict with irresistible social and economic forces which no power or combination can check. Wages have steadily risen ever since the foundation of the wage system. Unprecedented wars stimulate the trend of wages to great height, from which there is never full recovery to pre-war levels. The loss of man-power, the shortage of the labor market, increased demand for production following war days all contribute to forcing wages to new high levels. "Normal" movement in the long-time wage trend is completely disarranged and is not continued until after a series of years.

A careful analysis* of the long-time movement of hourly wage rates from 1840 to 1920, inclusive, compiled by the Bureau of Labor Statistics, throws considerable light on the subject. In 1860, at the start of the Civil War, the index stood at 39; by 1866, it had risen to 61, and by 1870 to 67. No marked decline occurred from even higher levels until 1876, when the index dropped to 64, but even the lowest point at any time in post-Civil War days was 59 in 1879, fourteen years after the close of the war. *Wages never returned to pre-war levels; while downward spirals took place, post-bellum wages were always on a higher level, and finally it took almost fifteen years of fluctuations to bring wages to more normal movements, and at greatly increased levels.*

Upon the above-mentioned chart (Fig. 1) the peak of wages (1920) is estimated at index 234, or 134 per cent above 1913. Assuming the average wage rate decline to the present time (as developed in a previous paragraph) to be approximately 25 per cent, the index to-day would stand at 176, or 76 per cent above 1913.

What is the "normal" index increase up to the present time? By normal, we mean the natural wage increase without war stimulations. Between 1900 and 1910 the wage increase amounts to 20 indices. If this same accretion be assumed to apply between 1910 and 1920, the index in 1920 would have stood at 113. Similarly, by 1930 the normal index would be 133, by 1940 it would be 153 and by 1950 it would be 173. It happens, however, that the curve of increase has followed an algebraic line rather than an arithmetical line. Such a curve is shown in the diagram, Fig. 2, and upon the curve will be found drawn three separate trend lines based respectively on a 10-year period from 1900 to 1910, a 20-year period from 1895 to 1915 and a 70-year period from 1845 to 1915. As the increase has been greatest in the most recent years, the trend based on the shorter period gives a higher line in the future than does the trend on the longer period. The intermediate period is represented by an intermediate trend line.

From the curve it will be noted that the high point of 1920 at 234 has given way to an estimated 176 in the summer of 1922. What the shape of the curve will be in the next few years is problematic. We have on the one hand the incessant activities of the labor unions pressing for higher and higher wages and, on the other hand, demands of economic adjustment pressing for a lowering of wages in those industries where they are now out of line, particularly in building construction, coal mining and railroad work. Hence, the lightly dotted curve from 1922 to 1940 on the chart may be regarded as a curve which is likely to be followed only in part by the developments of the next 15 or 20 years. Barring conditions of upheaval, however, it is probable that the course of wages will follow roughly some such line and strike into one of the normal trend curves somewhere between 1930 and 1940.

If we may take the post-bellum period 1865 to 1880 as an example of possible wage trends for the ensuing period, we may assume that we shall not reach the normal trend of wages until 1935 to 1940, and then at levels vastly increased over 1914. In other words, there never can be a complete return to 1914 wage levels, because those levels have been changed, in turn, by "normal" wage increases of succeeding years. The wages of 1870 and 1880 did not return to an 1860 base; likewise wages of 1922 or 1930 can never permanently recede to 1914 levels. Irresistible economic laws, therefore, prohibit absolute returns to pre-war conditions, and no group of forces, however powerful, can break these laws.

But not only can wages never return to the old 1914 levels because of economic laws, but also on account of social progress. Our general living and working conditions have risen tremendously since 1914, and not even the most reactionary folk can wholly decry the worth of this additional compensation in countless wage-earners' homes. While many will say that these increased standards have resulted in nothing but lost production and idle dissipation, others believe that this margin of social progress is one of the bulwarks of our democracy. The America of 1930 and 1940 will answer for us. However that may be, both from an economic and from a social point of view, there can be no permanent return to 1914 wages, and no groups, no matter how dominant, can force the issue.

Monthly Labor Review, February 1921, page 73.

Bauxite in 1922

The domestic production of bauxite in 1922 was at least twice as large as in 1921 and may reach a total of not less than 300,000 gross tons, according to James M. Hill of the U. S. Geological Survey. This quantity is about half of that normally consumed, yet the increase in output is encouraging, for it reflects a larger demand by all the consuming industries, particularly the abrasives industry. The operations in the Arkansas and the Eastern fields were larger, though in Arkansas car shortage in the fall limited to some extent the production.

During the first six months of 1922 the imports of bauxite averaged about 1500 tons a month, but since June they have been more than 3000 tons a month. The prices of domestic dried bauxite ranged from $6 to $10 a ton, but were lower in the last half of the year. The prices of pulverized and dried bauxite have ranged from $12 to $15 a ton, and of calcined from $20 to $25 a ton. The effect of a shortage of coal is reflected in an increase in the price of calcined bauxite during the later part of 1922. Under the new tariff the duty on bauxite is $1 a ton, whereas under the old tariff it was on the free list.

Shrinkage of Alloys

One of the fundamental problems under investigation by the Bureau of Mines in its alloy work is the contraction and shrinkage of metals and alloys in casting. Data on these values are of especial interest to foundrymen and others in the metal and alloy industry. Results of measurements on the linear contraction of a series of light aluminum alloys have just been published as Technical Paper No. 287 of the Bureau, and an investigation is now under way on the contraction of a series of commercial brasses and bronzes. A discussion of the technical aspects of contraction and shrinkage of non-ferrous alloys as related to casting practice is contained in Serial No. 2410, by Robert J. Anderson, metallurgist. Either or both of these reports may be obtained from the Bureau of Mines, Washington.

Promise of 1923 in Machinery Exports

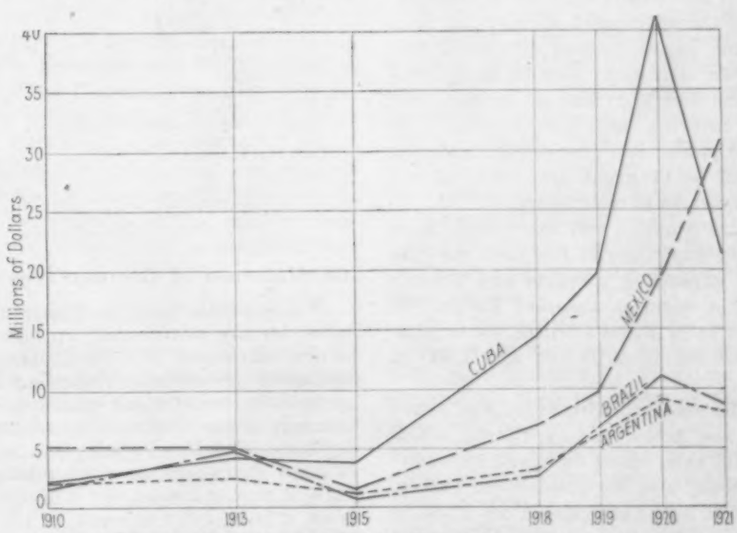
Conditions Which Now Control—Markets to Which Attention Should Be Given—Good American Participation in World Business Possible

BY W. H. RASTALL*

WALTER H. RASTALL

EXPORT orders are becoming more and more important to our manufacturers of machinery. In 1910 the total volume of our exports of industrial machinery was $51,489,598. In 1921 this total had expanded to $246,436,364. There is reason to believe that the average shop in the United States exports nearly 20 per cent of its production, which is so large a fraction that the export orders must be secured if the business is to be maintained in a prosperous condition.

The confusion of recent years has made it very difficult for the average manager to follow carefully the export side of his business. We have had war and reconstruction, the war boom, the armistice, a post-armistice boom, and the subsequent depression—all forces of world-wide extent, influencing our foreign markets with great effect, but affecting each a little differently—and in the matter of this confusion it has been difficult to recognize the markets that are expanding, as also those that will contract. Very important changes are developing in the flow of this machinery export trade—changes that should be followed most carefully by the export manager. The new year promises to be a good one in the machinery export trade, but it is necessary to arrange for constructive sales work in the expanding markets, curtailing elsewhere if circumstances justify. But first it is well to note the difficulties faced by competing countries.



Value of Exports of Machinery from the United States to Latin-American Countries from 1910 to 1921, Inclusive

Better Share of World Business

In 1913 Germany supplied about 44 per cent of the machinery absorbed in the international trade of the world, the United Kingdom about 29 per cent, and the United States about 21 per cent. All this has changed. Reconstruction has passed through the stage where we have felt most strongly the influence of depreciating German currency. Reports received recently from Holland, Belgium and Austria show that it is becoming very difficult to do business with Germany. The mark has had its "dance of death." It seems certain that during the coming year the machinery trade of the world's markets will be relieved of most of the confusion and demoralization that has accompanied the fall in exchange values, and the German sales policies of the last few years. In 1921 the United States supplied about 35 per cent of the machinery that went into international trade. On the score of engineering merit American machinery deserves a very much larger share of this business, and conditions justify us in expecting to receive it.

Similarly, manufacturers in the United Kingdom are suffering serious disadvantage. During the war these shops were turned to war work and the equipment adjusted on that basis. Few of the shops there are equipped especially for the particular products now manufactured. Also formerly these shops were equipped and "tooled up" on the basis of comparatively cheap labor and expensive materials. The war has changed all this. British labor is far more costly than formerly, and their managers are confronted with a whole group of problems as represented by changing demand, the loss of old markets, the development of new ones, the advancement of the art, increased tax burdens, trade restrictions, altered balance between labor, material and overhead costs, and probably it will not be possible for these producers to maintain the position in the world's markets that they once held.

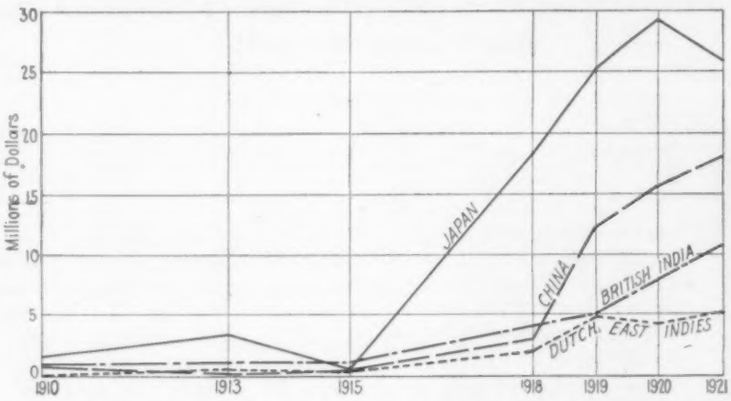
Handicaps of Foreign Manufacturers

The situation described above is not mere theory. It is supported by facts. Recently a large ore and coal handling equipment was installed in Rotterdam by an American manufacturer, and Rotterdam is one of the most competitive spots in Europe, German, British, French, Belgian, Swedish and other manufacturers having a great advantage on the score of freight charges, apart from everything else. Other of our manufacturers are selling textile machinery in various European countries, yet textile machinery had long been considered a British specialty. Spain has absorbed millions of dollars' worth of American machinery of a great variety. Even the United Kingdom and France buy vast quantities of our equipment.

But it should be emphasized very strongly that the sources of the demand for machinery are changing. The markets of Latin America, Australasia and Asia are absorbing a rapidly increasing percentage of such

*Chief industrial machinery division, Bureau of Foreign and Domestic Commerce, Washington.

equipment. In 1913 Asia absorbed 6.8 per cent of the industrial machinery exported from this country. In 1921 this had become 26.1 per cent. During the last four years we have sold more than $242,000,000 worth of such machinery to Asia, a total that is greater than we would have had in forty years at the pre-war rate. This fact alone is of outstanding significance, as such a volume of up-to-date American machinery in the hands of the teeming millions of Asia and close to the splendid resources of that largest of the continents means the release of forces that can scarcely be appreciated. Japan has often startled us with her progress. Asia is now taking the road that will modernize the whole continent.



Value of Exports of Machinery from the United States to Japan, China, British India and Dutch East Indies from 1910 to 1921, Inclusive

Changing Sources of Demand

Note the significance of the following facts. In 1913-14, India absorbed £112,170 of our machinery, in 1920-21 it was £3,463,640; in 1909 Java absorbed about $37,000, in 1919 it was about $4,000,000; in 1915 the Philippines took about $880,000 worth, in 1920 it had become $9,550,000; in 1911 China took $4,323,000, by 1920 this had become $27,944,000; in 1910 Japan took $7,493,000 worth of our machinery, in 1920 this had become $41,297,000. Also in all of these countries our participation in the trade had increased splendidly. This entire subject of the machinery markets of Asia is so important that the Department of Commerce sent a special investigator to visit every city of importance between Yokohama and Bombay, and in January will issue a special report covering the entire subject. This is a book of about 300 pages, and provides information that it is thought will be of great assistance to our manufacturers and exporters of machinery.

The markets of Latin America and Australasia have not shown such extreme expansion as has been the case in Asia, but they are expanding markets and deserve careful attention. Latin America absorbed $15,392,000 worth of our machinery in 1910 and $105,168,000 in 1920. Australasia took $3,000,000 in 1910 and $8,171,000 in 1920.

The situation in the more important of the above markets is shown in the accompanying charts, which appear to justify careful sales effort on behalf of American machinery. It should also be remembered that in these countries trade is not handicapped as it is in Europe. Many of them sell to us more than we sell to them. Exchange encourages trade. The yen, the Philippine peso, and the rupee are reasonably close to their pre-war levels. In South America conditions are far better than they were a year ago. The dollar Mex. and the tael are taken at about the bullion value of the silver content. The Canadian dollar and the Swedish crown have gone to premium values, the par ratio being maintained by gold shipments. Gradually the area of the free gold markets is expanding and with it goes business stability. The exchange fluctuations become very narrow.

For these and many other reasons, manufacturers of machinery should give unusually careful attention to their export markets during 1923. When Secretary Hoover reorganized the Department of Commerce some months ago he gave these problems special attention, and is now prepared to furnish dependable information regarding the methods used in selling machinery abroad, the nature of the demand in the various foreign markets, their comparative importance, and other particulars of use to the foreign sales manager. In the following list of countries that absorbed large quantities of American machinery in 1921 it will be noted that Mexico leads the list with more than $30,000,000, while Canada, Cuba, Japan, China, the United Kingdom, France and British India come next, in the order named, all taking more than $10,000,000 each. Germany, formerly a large importer of American machinery, took only $628,893 worth in 1921.

(1)	Mexico	$30,784,076
(2)	Canada	28,474,868
(3)	Cuba	21,307,814
(4)	Japan	20,941,408
(5)	China	18,184,978
(6)	United Kingdom	18,019,508
(7)	France	14,364,119
(8)	British India	10,772,891
(9)	Brazil	8,737,477
(10)	Argentina	8,007,785
(11)	Philippine Islands	5,529,555
(12)	Australia	5,510,167
(13)	Netherlands East Indies	5,061,080
(14)	Peru	3,770,184
(15)	Chile	3,561,510
(16)	Dominican Republic	3,252,954
(17)	British South Africa	2,907,183
(18)	Colombia	2,729,690
(19)	Spain	2,505,039
(20)	New Zealand	2,144,897
(21)	Sweden	1,957,928
(22)	Belgium	1,836,167
(23)	Egypt	1,733,625
(24)	Netherlands	1,600,471
(25)	Venezuela	1,422,439
(26)	Trinidad and Tobago	1,385,920
(27)	Rumania	1,311,582
(28)	Honduras	1,249,762
(29)	Italy	1,054,653
(30)	Panama	982,941
(31)	Germany	628,893

Investigation of Locomotives and Freight Cars

WASHINGTON, Jan. 2.—The iron and steel and other industries are manifesting an interest in a general investigation begun last Wednesday by the Interstate Commerce Commission regarding the adequacy of the locomotives and freight cars owned and used by the railroads of the country. The inquiry is to be extremely elaborate, and it will take into account all phases of railroad operations as they relate to equipment, and while it was taken on the initiative of the commission itself, it is expected to result in allaying a great amount of criticism based on misinformation or prejudice coming from various sources and directed against the various railroads of the country. The inquiry, in developing the exact condition and quantities of and requirements for rolling stock, will indicate the necessities of the carriers in the way of purchasing iron and steel, together with other materials. It also is intended to make it clear to the country precisely what the conditions of the railroads are in order to make clear the causes of car shortages and related questions.

Employees of the Truscon Steel Co., Youngstown, are being given the privilege of buying common stock at $14 per share, carrying the stock dividend right. Inasmuch as the stock is listed at $19.50, the company's offer is regarded as a generous one.

Problems Facing American Steel Industry

Maintaining Production Difficult Owing to Labor Shortage —Prospect of Exporting to Other Nations— The Struggle for World Trade

BY LUTHER D. BECKER*

LUTHER D. BECKER

STEEL mills in the United States are producing, on the average, 80 per cent (40,000,000 tons) of their estimated capacity, and at the moment this level appears to be the highest attainable. The best the German steel industry has been able to do since the surrender of plants in Alsace-Lorraine and elsewhere is 65 per cent of an estimated capacity of 14,000,000 tons; but Germany's problems are vastly different from those of the American industry. Germany's steel mills have been flooded with orders from within and without, but loss of iron ore production within its borders, shortage of coke due to the enforced deliveries to the French plants in Lorraine, and the depletion of its scrap supply have prevented the industry from working to capacity production. Great Britain has not since the war attained more than a 75 per cent output in its steel industry in relation to its capacity of 12,000,000 tons (about.) This volume of steel (9,000,000 tons) was turned out in 1920. In 1921 this had declined to about 3,700,000 tons, representing a percentage of production to capacity of 31. The year 1922 will record a rate of about 49 per cent. Unlike Germany, Great Britain has never been confronted with a shortage of raw materials in its steel industry. The country had reached the point of saturation in respect to both internal and external demand, the situation having been aggravated at certain periods during the four years since the war by long-continued stoppages of labor in its coal-mining and engineering industries.

Importance of Steel

The big problem facing the steel industry in the United States is one of working to full production, thereby employing capital and labor to the fullest degree. Capacity operation lowers production cost and insures a profit. Steel, embracing iron and engineering products, engages more capital and labor, serves more trades, and yields a greater value of product than any other manufactured commodity of commerce. Leaders in the industry have repeatedly pointed out that the last fractional part of the production often represents the profit of the whole output. Upon the full engagement of labor at adequate wages will follow the stimulation of every commercial activity of the United States because of the increased purchasing power from that source.

Excepting the relatively small steel export tonnage, about 2,000,000 tons, the 1922 volume of production in the United States represents solely internal consumption. The industry in November-December has operated at the highest level of the year, and with the domestic demand apparently satisfied, it does not seem possible to go beyond the 40,000,000-ton yearly average without looking elsewhere for the absorption of the surplusage of the 50,000,000-ton estimated capacity, or 10,000,000 tons. Perhaps the greatest problem of the steel industry for the coming years, surely one of vital concern, is to find foreign markets to absorb the surplus of 20 per cent or more.

Labor Shortage

Before developing this last problem further, it is necessary to state another problem which the industry must surmount in order to realize anything like 100 per cent production. This is shortage of labor, which is generally recognized to be particularly acute at this time. During the dull times of last year, many of the steel-mill workmen returned to their homes in foreign countries, taking back with them savings sufficiently large to make them feel independent. With the advent of better times and the resulting increased activity in the steel industry, the influx of immigration on the part of those central and southern Europeans who have in times past made up the bulk of the unskilled labor in the United States steel plants has been inadequate to meet the increased demand for this kind of labor.

Peak of Employment

Employment of labor in the steel industry reached its highest point in June, 1918, when 532,798 workmen were recorded. This total comprised only the blast furnace, steel works, and rolling-mill departments, and did not take account of such important operations in the industry as coal and ore mining and limestone quarrying. This peak of employment coincided with a correspondingly high level of operation in the industry on war production. Steel-mill capacity now is practically the same as then and even under an 80 per cent operative basis, there is an acute labor shortage. Assuming that 80 per cent of 532,798, or 426,238, represents the present total of workmen employed, the shortage of the potential employing capacity of the steel industry is more than 100,000.

Still another factor of this labor problem is that involved in the movement for the uniform adoption of the 8-hr. day, initiated by President Harding at the conference on May 18, 1922, at the White House, with prominent leaders of the industry. Obviously, then, any reduction of the number of working hours, which is already being accomplished in the industry, or the complete acceptance of the 8-hr. work day, will necessitate the employment of still more workers, and will apply especially to those units of the steel works requiring continuous operation. Under this plan of steel-works operation, a still greater demand will be made for common labor.

The solution of this labor shortage will undoubtedly be found in some wise revision of the existing quota immigration law along the line of selective rather than restrictive measures, whereby the number of immigrants permitted to enter the United States will be equal to the necessities of the domestic industries.

Exports of Steel

The United States has never exported steel for commercial purposes to the extent that its chief competitors—Germany and Great Britain—have, and from the standpoint of the relation of exports to total out-

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put, the comparison is strikingly unfavorable. The domestic market has always been able to absorb all but a relatively small percentage of its production. In the pre-war fiscal years 1913 and 1914, the annual export of steel (including pig iron, which represented a comparatively small portion of the whole) averaged 2,400,000 tons, or 7.5 per cent of production. The highest average was reached in the three-year war period, July 1, 1915, to June 30, 1918, when this annual movement was 5,300,000 tons. Shipments during these years comprised largely steel for munitions account, and yet represented only 13.2 per cent of output. Exports for the calendar year 1919 totaled 4,240,000 tons, or 12.1 per cent; for 1920 they increased to nearly 5,000,000 tons, or 11.6 per cent; for 1921 shipments declined sharply to 2,200,000 tons, or 10.9 per cent; and the present year will hardly show a level higher than 2,000,000 tons, or 6 per cent of production.

Great Britain's Policy

Great Britain, on the other hand, has always depended on its foreign trade to keep its steel productive capacity employed as fully as possible. In 1913 the outward movement registered a total of approximately 5,100,000 tons, including pig iron and scrap; in 1920, 3,300,000 tons; in 1921, 1,700,000 tons; and 1922 will show about 3,600,000 tons. The corresponding percentages of exports to production were: 50 per cent for 1913, 36.5 per cent for 1920, 46 per cent for 1921, and 61 per cent for 1922. In connection with these data it is to be remembered that pig iron and scrap form a good-sized part of Great Britain's export movement of steel. These items were especially prominent in 1922. The figures for the first ten months of the year disclose that, of the total sendings in that period, 21 per cent was pig iron, including ferroalloys, and nearly 5 per cent was scrap.

Germany as a Leading Exporter

Germany, just before the war, came into prominence as the leading exporter of steel. In 1913 its shipments of steel and pig iron totaled 5,600,000 tons, which, however, represented only 30 per cent of the total output. In 1920, having lost Lorraine to France, Germany was able to make foreign shipments to the amount of only 1,750,000 tons, or about 22 per cent. Exports in 1921 were estimated at 2,250,000 tons, or 25 per cent. The close of 1922 will probably show a slightly better yearly record for foreign shipments, which, based on the first eight months' figures, should approximate 2,400,000 tons. This would represent 26.5 per cent of the total production, estimated at 9,000,000 tons.

An analysis of the figures reveals that Great Britain surpassed Germany in the exportation of steel in 1920 by nearly two to one, but dropped behind in the following year to the extent of 600,000 tons. The decline in volume of foreign shipments was due to the long-continued coal strike in Great Britain in 1921. During 1922 Great Britain again forged ahead of its chief competitor and will show an advantage at the end of the year of about 50 per cent. The United States during the four years under review occupied third place in 1913, with about one-half of the export tonnages of Germany and Great Britain; first position in 1921; second in 1921, and went back to third place for 1922. The year 1923 may witness a realinement of the present ranking, with the United States finishing at least in front of Germany.

The World's Requirements

Our greatest problem resolves itself into these questions: What are the world's requirements for steel? What is retarding international trade? What is the outlook for world trade in 1923? What markets offer the greatest potential trade? What is the competition? How may the Department of Commerce at Washington assist the United States exporter of steel in winning his share of the world's trade?

It is generally recognized that there is a great steel shortage as a direct result of the war and its after-effects, including stoppage of labor in the world's coal mines, railroads, steel and engineering works. Experts have estimated this shortage in steel somewhere between 200,000,000 and 300,000,000 tons. In the eight years since the beginning of the war, railway, bridge and building construction and other steel-consuming projects of large proportions have been held up; rails, fencing, roofing, piping, machinery and tools have deteriorated and only a small part has been replaced. New railroad mileage planned before the war for China, Russia, British India, South Africa and South America will probably get under way in 1923. A conservative estimate of these projected undertakings is 250,000 miles of track, representing more than 25,000,000 tons of rails. The tonnage of steel for bridges and railroad equipment entering into this new construction would run this total up to a huge figure. In the shipbuilding industry only have the world's normal requirements been satisfied. Along other lines of steel consumption for which there is a need, and which cannot be postponed much longer, the aggregate is beyond computation. Furthermore, the use of steel is ever increasing. The substitution of steel for wood (as a consequence of the depletion of forests) and stone are other factors contributing to the world's insatiable demand for this universal metal.

International Credit

Recovery in international trade awaits the restoration of international credit, which can be accomplished only through the settlement of German reparations and interallied debts. Germany and France hold the key to the solution of this problem. When the last German ministry was supplanted by the present cabinet, comprising business and industrial leaders, a feeling was entertained that at last the problem would be met. France's less exacting attitude toward Germany lends further encouragement to the expectation of an early solution satisfactory to all.

The year 1923 promises better foreign trade in steel than was enjoyed in the year just closing. Encouraging signs appearing in various sections of the world to warrant an optimistic outlook are these: The recent rise in sterling to $4.69, the highest level attained in almost four years, and in French francs and lire; the stabilization of the mark, even though at the vanishing point, for over a month. A better understanding with regard to the Near East situation removes, in part at least, a fear of developments that threatened to disrupt the whol eworld. The Mussolini ministry in Italy promises much for Italian industrial and commercial prosperity. In the Far East, Chinese exchange is back to normal; the Japanese yen, never far below parity of exchange, is gradually returning to normal; the British Indian rupee has recently recovered lost ground and is close to par; the guilder of the Dutch East Indies is about normal; and exchanges in Australia, New Zealand and South Africa are keeping pace with the rise in sterling. In the Latin American group the following countries afford good examples of fair to normal currencies: Argentina, Colombia, Venezuela, Mexico, Honduras, Nicaragua, Panama and Cuba. Japanese exports and imports of all commodities in the first nine months of 1922 increased nearly 35 per cent and 30 per cent respectively over the corresponding period in 1921, and although the trade balance is still adverse, business men feel encouraged by this showing. A cabled report from South Africa states that stocks of commodities are low and it is expected that imports will increase in 1923. Similar advices from all parts of the world are being received in the Bureau of Foreign and Domestic Commerce, indicating the vanishing point of stocks of

steel products and pointing to the early months of the coming year as likely to mark the inception of a vigorous buying movement. It is not expected that there will be anything like a boom, for the purchasing power of the world must first be built up, and this will be a slow process, dependent upon the gradual restoration of international credit.

The Latin-American Demand

Before the war the United States, following along the paths of least resistance, found its most productive fields for steel exports in the near-lying Latin-American countries. The war presented an unusual opportunity to the United States manufacturer and exporter of steel to explore hitherto untouched sections of the world where trade was carried on in large volume, but under the domination of German and British manufacturers and large exporting and importing houses. The Far Eastern peoples took a liking to United States manufactured steel products and have been calling for them ever since. As a consequence of the seizure of this war-time opportunity, the United States now finds its greatest potential markets in the Far East.

The following summary will serve to illustrate the shift which took place in the world's markets for United States steel products from Latin America in 1913 to the Far East in 1921, the last year for which there is a complete year's record. The table also shows the 20 leading sources of trade in these two calendar years. (Values are stated instead of volume in order to include all items of iron and steel and their products, some of which are not reported in units of weight.)

Twenty Leading Markets

Twenty Leading Markets for United States Steel Exports in 1913 and 1921

Markets	1913	1921
Japan	$6,500,000	$35,500,000
Canada	54,300,000	33,400,000
Mexico	6,100,000	27,600,000
British India	1,400,000	13,000,000
Cuba	5,300,000	12,300,000
Great Britain	8,600,000	11,000,000
Argentina	4,100,000	10,200,000
Dutch East Indies	540,000	9,900,000
Australia	6,300,000	8,300,000
Brazil	3,900,000	7,800,000
China	1,500,000	6,700,000
France	130,000	5,300,000
Chile	3,100,000	5,200,000
Peru	800,000	5,000,000
Philippine Islands	2,000,000	4,700,000
Italy	930,000	4,000,000
Colombia	820,000	2,400,000
Persia	.....	2,100,000
Hongkong	310,000	1,800,000
Kwantung (leased territory)	84,000	1,700,000

The 20 markets designated in the table took nearly 90 per cent of the United States steel exports in 1921. According to regional groupings the figures show that the Far East received 39 per cent, Latin America 34 per cent and Europe 10 per cent. Canada accounted for 16 per cent and Persia 1 per cent.

Outlook for Exports

United States exports of steel, including pig iron and scrap, in the first ten months of 1922, totalled 1,731,299 tons. At this rate the year will show a level of slightly more than 2,000,000 tons. The principal sendings in the ten months' period were: Steel rails, black steel sheets, steel bars, tubes and pipe, structural shapes, plain wire, galvanized sheets, blooms, billets and sheet bars, plates, tin plate and barbed wire, in the order named. It is interesting to note that the United States export steel tonnage is almost entirely made up of finished rolled products, whereas that of Great Britain, Germany and France comprises a considerable volume of pig iron and scrap. Ingots and semi-finished steel, moreover, help to swell the French exports. In the period just reviewed, shipments from the United States of pig iron and scrap combined were under 5 per cent.

The completed figures for 1922 will probably record losses or gains in certhin markets listed in the foregoing statement, but the group arrangement will remain unchanged.

Japan an Important Customer

Throughout the Far East, United States manufactured steel products, particularly those which bear brand designations, are intimately known by every importer and user of steel. In Japan, for example, when a consumer in the interior wants water pipe or galvanized sheeting, he invariably calls for brands of United States origin. The Japanese importer and dealer recognizes and caters to the popular demand and carries large stocks of these materials. At intervals of economic unsettlement, as is the case at the present time, Japan may drop behind in its purchases of steel, but it can be counted on as the United States' most fruitful market for the disposal of a good part of its steel surplus. It must also be remembered that the United States is Japan's best customer, receiving the bulk of its raw and manufactured silk, vegetable oils, ceramics, toys and many other commodities. Again, the markets of the world with high exchange values or with currencies at or near parity with the American dollar will present the best opportunities for United States trade.

Of the remaining Far Eastern countries, British India, China (including Manchuria), Australia, the Philippine Islands, the Dutch East Indies, New Zealand and South Africa may be expected to absorb in varying proportions large quantities of United States manufactured steel products in 1923 and coming years.

The iron and steel industry of British India will not for many years be able to supply the huge internal demand for: Rails to carry out the Government's mileage program (without added railway transportation the steel industry itself cannot expand); harbor and dockage improvements; bridge building and highway construction; barrages for irrigation purposes; line pipe and oil-country goods for the Burma oil fields; grain elevators; hydroelectric equipment; tin plate for oil containers; and the diversified manufactures of steel used in the daily life of India's teeming population. Germany's present hold on this Indian trade cannot continue for long, and the coming year will probably see the return of Great Britain's dominance of the steel trade of this, its most important, colony. The United States, by a concerted and well-directed effort, can maintain the trade already started during and after the war and can win an increasingly larger share of the huge potential trade.

The Chinese Market

China may not figure extensively as a buyer of steel in 1923. Nevertheless, the Chinese market should be given close study and attention by American exporters of steel products. The recent turning over of Shantung to China by Japan may well mark the commencement of a better economic era for the Chinese people. Shantung is one of China's richest provinces and can furnish the means for a considerable exchange of goods in the international trade markets. Although rich in iron ore and coal, China has not yet succeeded in developing a steel industry such as exists in India. Its present steel-plant equipment is obsolete and inadequate to provide even a small part of China's present-day necessities. In the distant future, perhaps not in this generation, the curtain will rise and China will build miles upon miles of railroads, contiguous to which will spring up industrial enterprise on a scale perhaps equalling that which was unfolded in the history of the United States.

Australia has placed a rather rigorous tariff on foreign steel products to protect its domestic industry, and the mother country has an advantage over other

steel-producing countries of 5 per cent and more. However, with Australia's steel plants closed since the early part of this year and with no likelihood of their resuming operations in the immediate future, the United States should do better in that market in 1923 than in the year just closing. New Zealand and South Africa likewise favor Great Britain in their tariff arrangements, but like Australia, are favorably disposed toward United States steel products and, with rising currencies, offer no insurmountable obstacles to the winning of a share of their trade.

The Philippine Islands

In the Philippine Islands United States representation is at its best, thereby assuring a major part of their steel trade to American mills. The outlook for 1923 is dependent upon new undertakings for the islands. The island of Java in the Dutch East Indies (with a population of 34,000,000) consumes a larger volume of steel manufactures than is commonly known. The Dutch trader in Java is more nearly akin in trading proclivities to the American than any other national. He found satisfaction with United States steel manufactures during the war and after the armistice, and continues to send his inquiries to his American connections. But price governs his purchases, and for the time being Germany is supplying his immediate requirements at lower prices than the United States exporters can meet. Profitable sugar production in Java will largely determine the volume of its steel buying in 1923. A survey of the Far East would not be complete without a reference to the little kingdom of Siam, which has a population of about 9,000,000. In the present year the Siamese Government has been actively engaged in getting under way a five-year railroad building program and has already placed an attractive contract for rails. There was keen international competition, in which United States manufacturers played a part, but the business went to European interests. The need in Siam is American representation, without which it is feared that their share in this productive trade will be small. This statement concerning the lack of Americans "on the job" might be applied with equal truth to many other markets of the world where United States agencies are at the mercy of other nationals who are more concerned with pushing the sales of their own commodities.

Markets to the South

United States interests in South America, Mexico, Central America, Cuba, and the lesser islands comprising the Caribbean group are perhaps better looked after than in other sections of the world. With the restoration of international credit a steady improvement in their currencies will enable the Latin American peoples to exchange their produce for the necessities in steel goods and also for the steel required in vast undertakings of railroad construction postponed for lack of financing. Latin America can be counted on to take a considerably larger quota of the United States steel output than in the current year.

Canada occupies a unique position in respect to its absorption of United States steel. In point of steel tonnage Canada was the United States' best customer until the latter part of 1921, when it was surpassed by Japan. The figures for the first ten months of 1922 show that Japan took 35 per cent more steel than Canada. However, in June Canada again took the lead over Japan and has maintained first position to the end of this period, with a good margin. Indications are that Japan's lead will not be greatly reduced by the close of the year, and this great industrial nation will for the first time be credited as the United States' leading steel customer.

Low exchange and high transportation charges will bar United States export steel from continental Europe in 1923 in any large volume. In Great Britain price will be the controlling factor and will determine whether continental or American imports of semi-finished steel shall be supplied.

Competition for World Trade

Competition for the world's steel trade will be mainly between the United States, Great Britain, and Germany, for these are really the only great steel-producing or steel-exporting nations of the present day. France may some day occupy a predominant position as a metallurgical power, but before becoming an export factor in the international markets it must first organize production, locate adequate supplies of coal and coke, and procure men for the necessary labor, for which its people are not particularly adaptable. Belgium has made wonderful strides in its steel industrial development and, with its added interests in Luxemburg, is in a better position now than before the war. However, after supplying the internal needs of the country, whatever surplus there may be will constitute only a small part of the world's demand for steel.

With the return of world stability and normal commerce, that nation which can produce and ship its steel manufactures most economically will win the largest share of the world's trade in steel.

Reorganization of the Bureau of Foreign and Domestic Commerce along commodity lines was undertaken by Secretary Hoover the middle of 1921, and export machinery was set up to assist the manufacturer and exporter of steel products in promoting his foreign trade. The personnel of the several divisions of the bureau—commodity, technical, and regional—comprises men who have had years of trading and investigational experience in foreign fields and who are prepared to furnish information of the kind and character essential to the conduct of an export business in all its complex phases. The fact that this service is freely offered to American companies is no argument against its quality or thoroughness. American firms desiring to launch out in foreign trade for the first time are particularly invited to send in their queries, or, better still, a personal visit to Washington is recommended.

Theoretical Advantages of Electric Melting of Brass

The theoretical advantages of electric brass melting are summarized by the U. S. Bureau of Mines as follows: (1) Melting may take place in a neutral or reducing atmosphere, thus minimizing loss of metal by oxidation and improving the quality of the product through freedom from oxides; (2) metal of crucible quality may be obtained without the use of crucibles; (3) melting may take place in a tightly closed chamber, or at least in one free from the constant passage of the products of combustion of fuel, and thus losses of volatile metals such as zinc and lead may be reduced. Contamination by sulphur from fuel is avoided; (4) in some types of electric furnaces the temperature may be more readily controlled than in fuel-fired furnaces; (5) in some types of furnaces the molten metal is thoroughly stirred, thus giving a uniform product, even with large heats; (6) there is no handling or storage of fuel, such as coke, coal or oil, and no ashes have to be removed. The cost of power can be accurately predicted over longer periods than the cost of fuel; (7) working conditions about the furnaces are less dangerous to health and safety of workmen, provided suitable types of furnaces are chosen; (8) the above advantages may be obtained in furnaces of larger capactiy than can be used satisfactorily in the fuel-fired crucible types, with resulting greater uniformity of product, lower labor cost, and increased production.

Power Problems of Rolling Mills

Stresses of Roll Motors and the Over-powering of Mills—Human Equation of the Roller—Influence of Power Factor

BY A. H. DYCKERHOFF

WHEN scrutinizing motor applications on roll trains, it is found that many motor ratings are seemingly out of proportion with the rolling mill duties generally practised and that mills of apparently the same character are driven by motors of different capacity. This is the more surprising in face of the superiority of motors in handling great overload capacity, as compared with steam engines. A few examples may illustrate this: There are installations of 45 in. blooming mills, two of which have a difference in motor capacity of 1500 hp. continuously, or of about 6500 hp. maximum. Two 36-in. reversing blooming mills are operated by motor units, the rating of which varies by more than 3000 hp. continuously, while two 40-in. reversing blooming mills have a difference in the maximum motor rating of 5000 hp. Plate mills frequently show incongruity of roll width and of their motor rating. Some sheet bar mills of about the same type are driven by motors with a rating varying by almost 3000 hp. continuously.

There are a multitude of reasons for such a condition, reasons which are more or less defined. In some cases other installations have served as prototypes for the new ones, which, as designed, embody the same draw-backs as the former; in other cases extraordinary expectations and ambitious tonnage demands, by the individual mill superintendent have led to excessive motor ratings, as has the intention of increasing the severity of mill practice, *i. e.*, of introducing heavier drafts. Further, the indefiniteness of the future rolling schedule sometimes induces the engineer to provide for a driving mechanism of very ample rating.

However, all such demands cannot be satisfied without certain sacrifices involving high first costs of motor and control, inefficiency, low power-factor and inability of line and generators to deliver power, resulting thereby in costly operation of the prime-mover and poor voltage regulation. Besides the foregoing reasons, other causes inherent in the rolling process, such as extremely variable and indefinite stresses of rolling, are responsible for the selection of large motors to meet all possible exigencies.

Stresses at the Mill

In the first place, the uncertainty and variability of the temperature of the steel to be rolled must be considered, and likewise the variable pressure required between rolls and steel, which pressure naturally is a function of the temperature. The same heating furnace may supply the steel with an initial temperature varying from 2200 deg. Fahr. to 2000 deg. Fahr., due to various reasons, as poor gas, etc. The result is that the required pressure acting upon the steel is about 45 per cent higher at 2000 deg. than at 2200 deg., entailing equally higher stress in the whole driving mechanism.

Furthermore, the rolling temperatures for various materials are different; for instance, that of chromium nickel steel is 2000 to 2100 deg. Fahr., that of spring steel about 1920 deg. Fahr., that of chrome-vanadium some 2200 deg. Fahr., and that of manganese steel also 2200 deg. Fahr., thus imposing different stresses on the mill. Again, the rolling temperature of the steel itself is not absolutely definite, the core and the skin showing a difference of 50 to 200 deg. Fahr., and frequently a marked difference of temperature exists between the bottom and the top part of the stock being rolled.

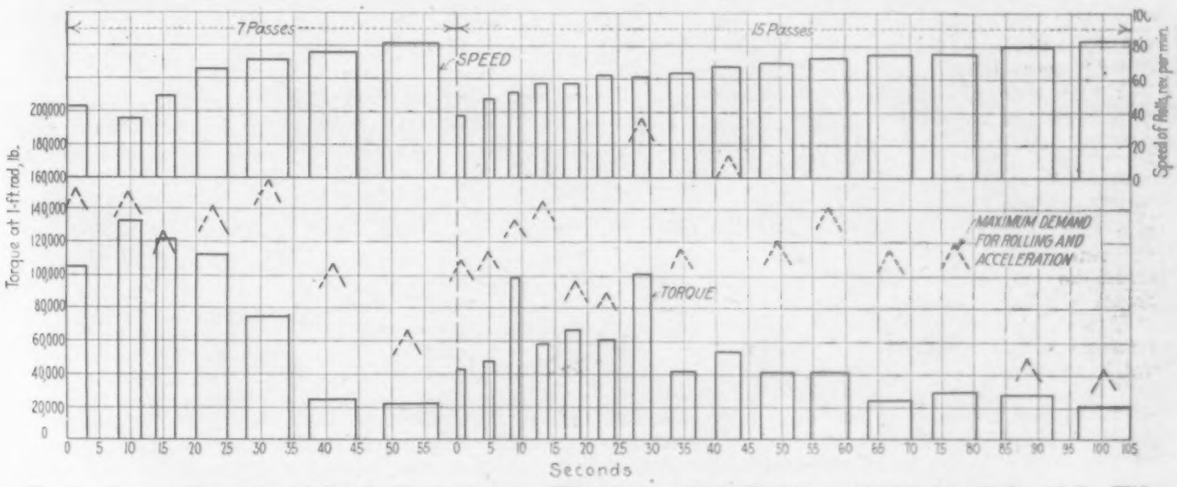

Fig. 1. Torque (Bottom) and Speed (Top) Diagrams When Rolling Slabs Weighing 1080 Lb. into Plates 12 In. Wide and $\frac{1}{4}$ In. Thick—Seven and Fifteen Pass Schedules Compared

Due attention should be given to the kind of steel to be used for a certain mill drive, a factor which must not be neglected. It is not immaterial if the steel has an ultimate tensile strength of 55,000 lb. per sq. in. or of 85,000 lb. per sq. in. Frequently the opinion is erroneously expressed that such difference in physical properties disappears at the high rolling temperature, but it is evident that entirely different stresses in the mill will result from steel of different properties, although general practice is to roll steel of a higher tensile strength at less draft and at a lower temperature.

Another variable quantity is the coefficient of friction between rolls and steel. Due to the unstable nature of the rolling process and to the difference in velocity of rolls and the surface of the steel, the friction varies constantly and considerably. The importance of the variable friction between rolls and steel surface also makes the consideration of the velocity difference (commonly called "lead in rolls") imperative, to arrive at proper conclusions of actual stresses in the mill. Without these factors, any calculation is naturally incomplete.

The result of the great variability of the foregoing factors is variable pressures at the roll necks and

bearings and thereby a variable coefficient of bearing friction. In addition, the bearing friction is greatly changed by the setting of the rolls, so that the friction at light load may easily vary by 5 to 35 per cent from the lowest to the highest value, depending on the type of mill. At the same time it must be taken into account, when figuring roll resistance, that the losses in the pinions are not constant, but greatly dependent on the power transmitted and the angle of the spindle.

Another uncertainty is the amount of draft on certain classes of roll trains. In such cases the human element of the various rollers plays an important part; every roller has his "own experience," he changes his practice frequently, guided merely by his intuition. In a good many cases the so-called mill practice will serve its purpose, but has no regard for sound principles of economy, as will be shown further on.

Due to the higher overload capacity of the roll motor than that of the steam engine mill, operators are easily induced to increase the draft and to obtain a larger tonnage on the mill. This merit of increasing the tonnage and thereby reducing the cost of operation is justly claimed and deserved by the electric drive, even not counting the lower conversion losses of the electric drive from power line or fuel. With a larger draft at each pass, and with a smaller number of passes thereby, the net work required at the roll coupling is materially reduced. This, however, can be accomplished only by higher stresses on the roll motor.

Such conditions are illustrated, in an extreme instance, in Fig. 1, which shows the stresses at the mill spindle for rolling the steel only, *i. e.*, without light load of mill, expressed in pounds at 1 foot radius, together with the speed of the rolls when rolling slabs of 1080 lb. to universal plates 5/16 x 12 in. in seven and fifteen passes. Both slabs had the same initial dimensions, the same physical properties and weight and the same initial temperatures. The diagram is based on actual tests. The highest stress of the seven-pass slab is 132,200 lb. (at 1 ft. radius) and that of the 15-pass slab, 102,000 lb. Since the amount of the draft for the two slabs was left to the roller, it is no surprise that the seven-pass slab requires a torque only 30 per cent greater than the 15-pass slab, while there should be a difference of 50 to 60 per cent, with a proper selection of drafts.

This influence of the human element is still more apparent when the maximum stresses are considered which are required for rolling and for the acceleration of the rotating masses. Under such conditions (shown in Fig. 1 by dotted arrowheads), a maximum torque of 158,000 lb. is demanded by the seven-pass slab and 198,000 lb. by the 15-pass slab, a proof that, due to the personal element, the motor was subjected to a higher stress when rolling the slab in more than twice the number of passes. However, if the plain algebraic average of the various stresses is taken into consideration, the seven-pass slab requires an average torque 59 per cent greater for the rolling, and only 8 per cent greater for rolling and accelerating, than the 15-pass slab.

As pointed out above, the smaller number of passes demands less net work. In the foregoing, the expenditure of net work in foot pounds for rolling the 15-pass slab is 24.5 per cent greater than for the seven-pass slab. This does not appear to be very much. If, however, the efficiency-circle diagram is developed, based on the actually measured work and time, with eight seconds between slabs for an output of 22.2 tons finished per hour for the seven-pass slab and of 12.15 tons finished for the 15-pass slab, the result is that the 15-pass slab schedule demands 47.6 per cent more fuel than the seven-pass schedule.

Combined circle diagrams for these two schedules are diven in Fig. 2, showing the distribution of work expended from roll coupling to fuel, based on an overall thermal efficiency of the power plant of 19 per cent. The efficiency from roll coupling to fuel of the 15-pass slab is 5.99 per cent and that of the seven-pass slab 7.11 per cent. This seemingly small difference, 1.12 per cent at the mill coupling, represents 229,000,000 ft. lb. per ton, or 294,800 B.t.u. per ton in fuel. This would mean, at that tonnage, a yearly saving of 2070 tons, which, at $5 per ton, makes $10,350.

The basic data for the foregoing slabs were obtained by means of oscillograms similar to that shown in the first six passes in Fig. 3. The data shown in Fig. 2 appear also in the table.

	7 Passes		15 Passes	
Foot-pounds in the fuel	481,000,000 =	100.0 %	710,000,000 =	100.0 %
Electric power plant loss	389,600,000 =	81.0 %	575,000,000 =	81.0 %
Line loss	1,750,000 =	0.36%	2,200,000 =	0.31%
Excitation loss	12,150,000 =	2.53%	16,800,000 =	2.37%
Flywheel set losses	36,100,000 =	7.5 %	60,700,000 =	8.53%
Motor losses and mill friction	7,200,000 =	1.5 %	12,800,000 =	1.8 %
Net work for rolling	34,200,000 =	7.11%	42,500,000 =	5.99%

Stresses of the Motor

All the variables in the mill proper, as mentioned above, have a direct bearing on the stresses of the mill motor, aggravated at times by the practice of the operators, as shown in the foregoing case of reversing universal plate mill motors. Here the reaction on the power plant is not immediate, but only through the interposed fly-wheel set, while alternating current motors driving mills operating in one direction reflect their stresses more directly on the power plant. Likewise, any changes of conditions on the line and power plant have a certain influence on such motors, adding to their stresses under certain circumstances, a condition which must be kept in mind when selecting large motors. Such additional stresses can be due to variable frequency and voltage; usually both occur at the same time.

Fig. 4 gives a frequency curve which shows a mild form of a variable frequency with a change from 24 cycles to 26 cycles within about 18 minutes. This corresponds to 4 per cent variation above or below 25 cycles, or 8 per cent total. Many arguments can be heard about the permissible amount. I have found that many European steel mill plants show 4 to 5 per cent total variation, or 2 to 2.5 per cent above or below the standard frequency, while others here, as well as abroad, go as far as 10 per cent and more. Practice shows that such excessive variations are a handicap in the continued operation of the plant. A total variation of 5 per cent is permissible, but all excessive frequency changes are generally due to insufficient generating capacity.

Now, what effect do these variable conditions have on the line? Generally, under normal conditions, heavy rotating masses alleviate the stresses on the motor; they also assist the motor when the frequency decreases. However, if the frequency is increasing while the passes occur on the mill, the motor is subjected to a higher stress and must deliver a greater torque in order to speed up the heavy rotating masses as fly-wheel, etc., in proportion to frequency increase, though naturally a certain amount of kinetic energy is derived from the masses. Such additional stress depends largely on the characteristics of the motor and the time element in which the increase takes place.

Changes of increase of frequency of ½ cycle take place frequently in two seconds, and of one cycle in six seconds. Proportionally, considerably more time is required if the frequency is very low. Likewise, low voltage adds to the stresses of the motor. Since the torque is proportional to the square of the voltage, the current increases correspondingly with decreasing voltage for a practically constant torque, as determined by the resistance of the steel. Both low frequency and low voltage augment the heating of the motor.

Other features influencing the stresses on the motor proper are the moment of inertia of the rotating masses in connection with the control of the secondary of the motor, the characteristics of the motor and the mechanical structure of the mill, which all must be considered in their relation to the actual stresses on the mill. The selection of the rotating masses, together with the total drop in speed, depends greatly on the form of the load curve and on the type of mill, *i. e.*, large masses and small speed drop are used generally for mills with a great variation of load, short passes and short intervals. The question of how the speed drop is to be attained by an a.c. in-

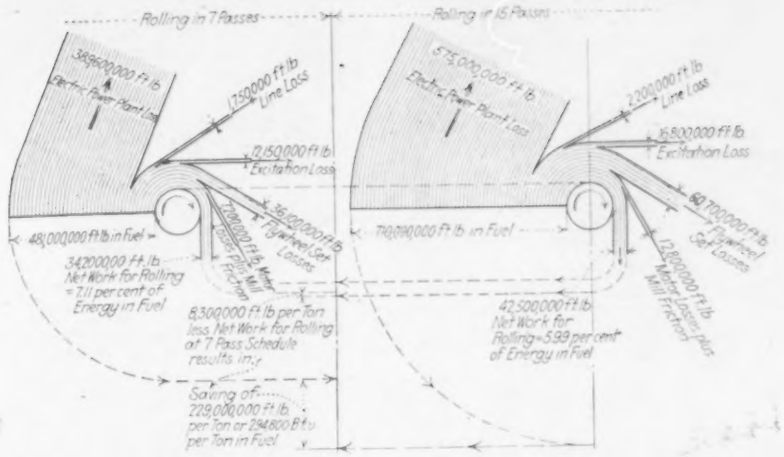

Fig. 2. Efficiency Circle Diagram for Slabs of 1080 Lb. When Rolled into 5/16 In. x 12 In. Plates. The distribution and dissipation of power is traced for both the 7-pass and the 15-pass schedule, showing that the former excels both in percentage of efficiency and in low total power requirements

duction motor, either by fixed resistance in the secondary of the motor, or by notch back control, or by the liquid type rheostat is frequently the cause of heated arguments.

If these three types are placed in order as to the greatest assistance in alleviating the stresses on the motor, they should be enumerated: First, liquid type rheostat; second, notch back control; third, fixed permanent resistance. There is no doubt that the majority of American and European installations are using the liquid type rheostat. This type, of all three, secures the most uniform demand from the power plant, but is at times sluggish in accelerating the masses between passes. In this latter respect, the permanently inserted resistance appears to have the advantage as to accelerating the rotating masses more quickly and thereby avoiding delays in the mill. This, however, can be accomplished only by thrusting heavier power demands on the power plant.

Consequences of Over-powering Mill Drives

All these variable factors of the mill, of the power plant and of the motor end (fly-wheel, control) must be considered to specify a proper rating of the motor, as based on the heating of the motor, or on the maximum stresses. Which of the latter is to be chosen depends on the character of the load curve for the motor. To safeguard against all such exigencies, motors of too large a rating are frequently chosen, a fact which is by no means always the fault of the engineer. The results are, as pointed out above, low power factor, lowered efficiency of the motor, high losses in the transmission line and poor voltage regulation, loading the generating units with reactive power and decreased prime mover efficiency.

For the sake of illustration, I have selected a 132-in. plate mill drive and computed the stresses occurring on the mill referred to motor coupling (see Fig. 5) when rolling a slab of 2.79 tons weight (68 x 36 x 9 in.) to a plate 264 ½ x 114 x 9/16 in. in 27 passes. This case illustrates a severe rolling cycle on a plate mill of that size. The diagram is based on material of 52,000 lb. per sq. in. ultimate tensile strength, and on the drafts as prescribed by the mill practice. That

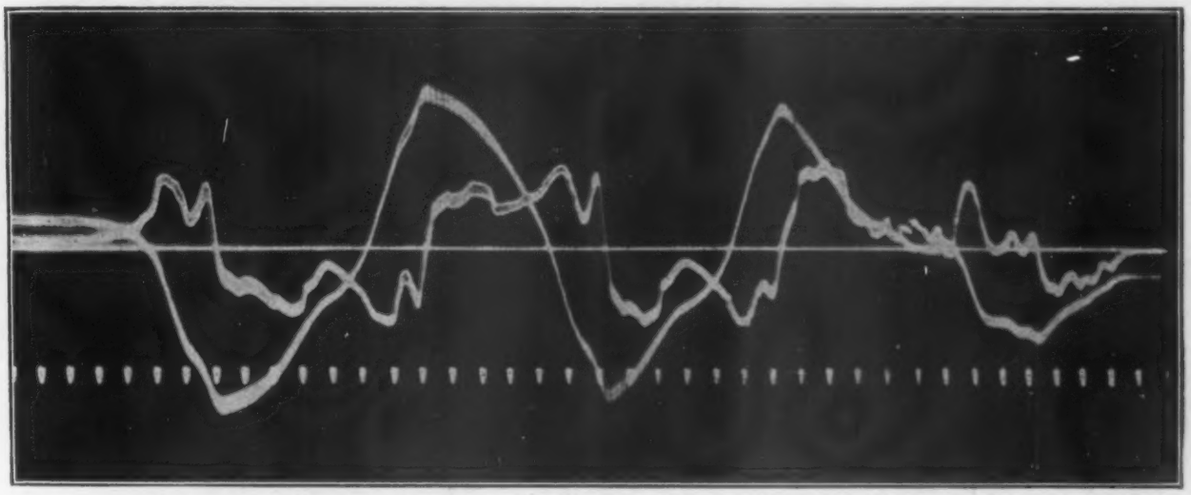

Fig. 3. Reproduction of Oscillograph Record, from a Series of Which the Basic Data Were Derived for Constructing the Several Diagrams

such practices are by no means beyond criticism is easily seen from this diagram, which shows that the stresses between passes three and fifteen vary by almost 900 per cent (57,200 to 567,000 lb. at one foot radius) and between passes seventeen and twenty-seven, by about 400 per cent (184,000 to 940,000 lb. at one foot radius). Evidently more uniform stresses could be attained by changing the mill practice and thereby a saving could be made in first cost and operating expenses.

Based on the prescribed practice, the average load

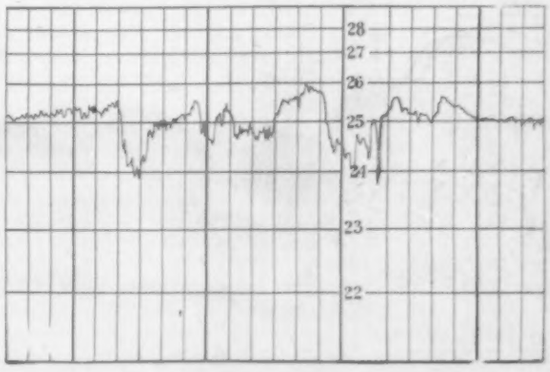

Fig. 4. Frequency Chart, Showing a Change from 24 Cycles to 26 Cycles Within 18 Minutes

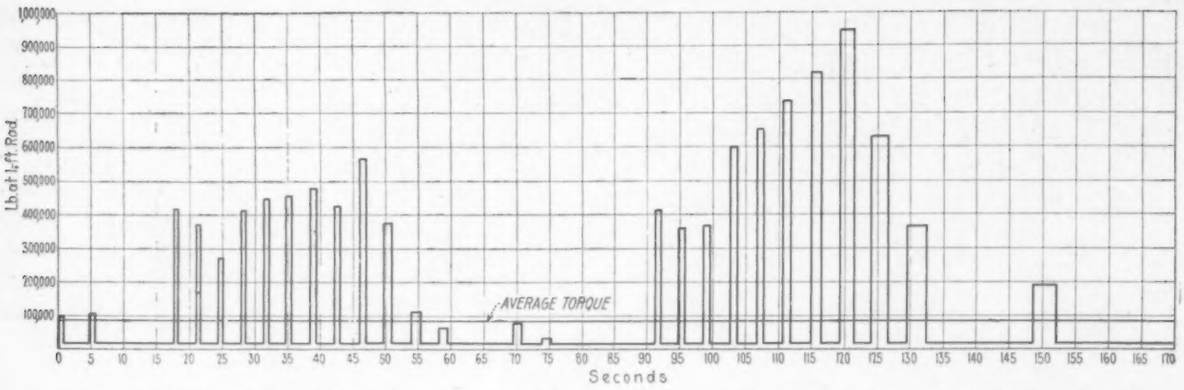

Fig. 5. Resistance (Computed) Referred to Roll Motor Shaft When Rolling Slabs of 68 x 36 x 9 In. into Plates of 264 x 114 x $\frac{9}{16}$ In.

on the motor is only 1312 hp. and the average torque 85,100 lb. The motor is to operate at a synchronous speed of 85 r.p.m. at a prevailing frequency of 25.5.

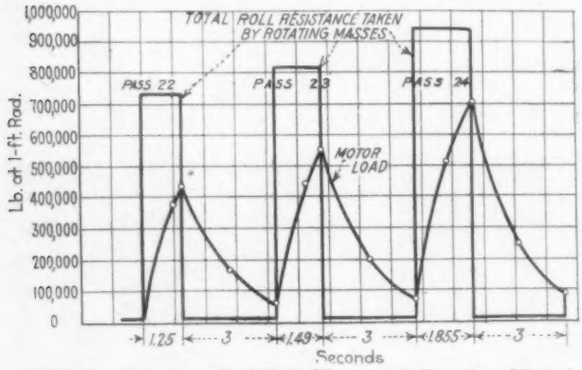

Fig. 6. Interaction of Roll Motor and Rotating Masses, Showing Influence of the Flywheel in Holding Down the Peak Demands on the Electric Unit

The rating based on the heating of the motor is equivalent to about 2500 hp., corresponding to a torque of 162,300 lb. at 81 r.p.m. Between the motor and the mill there will be interposed a fly-wheel of 90 tons, weight, its amount of inertia and that of the motor amounting to 650,000 lb.

Due to the interaction of the rotating masses and of the motor, the stresses on the mill are taken partly by the rotating masses and partly by the motor. This is shown for the most important passes, Nos. 22, 23 and 24, in Fig. 6, which gives a maximum stress at the motor shaft of 705,000 lb. Since the normal torque of the motor is 162,300 lb., the machine has to stand an overload of $\frac{705,000}{162,300}$ or 4.35 times the normal torque. For this reason, the rating cannot be based on the heating of the motor, but must be selected on the maximum stress of 705,000 lb. If a 4000-hp. motor is chosen, which has an equivalent normal torque of 259,000 lb., the overload would amount to $\frac{705,000}{259,000}$ or 2.725 times the normal torque. This condition can be met by the improperly designed motor. A different mill practice would, under equal conditions, require a maximum stress on the mill of about 700,000 lb. and of about 550,000 lb. at the motor shaft, decreasing the rating of the motor to 3150 hp.

To see the effect of this 4000-hp. installation on the

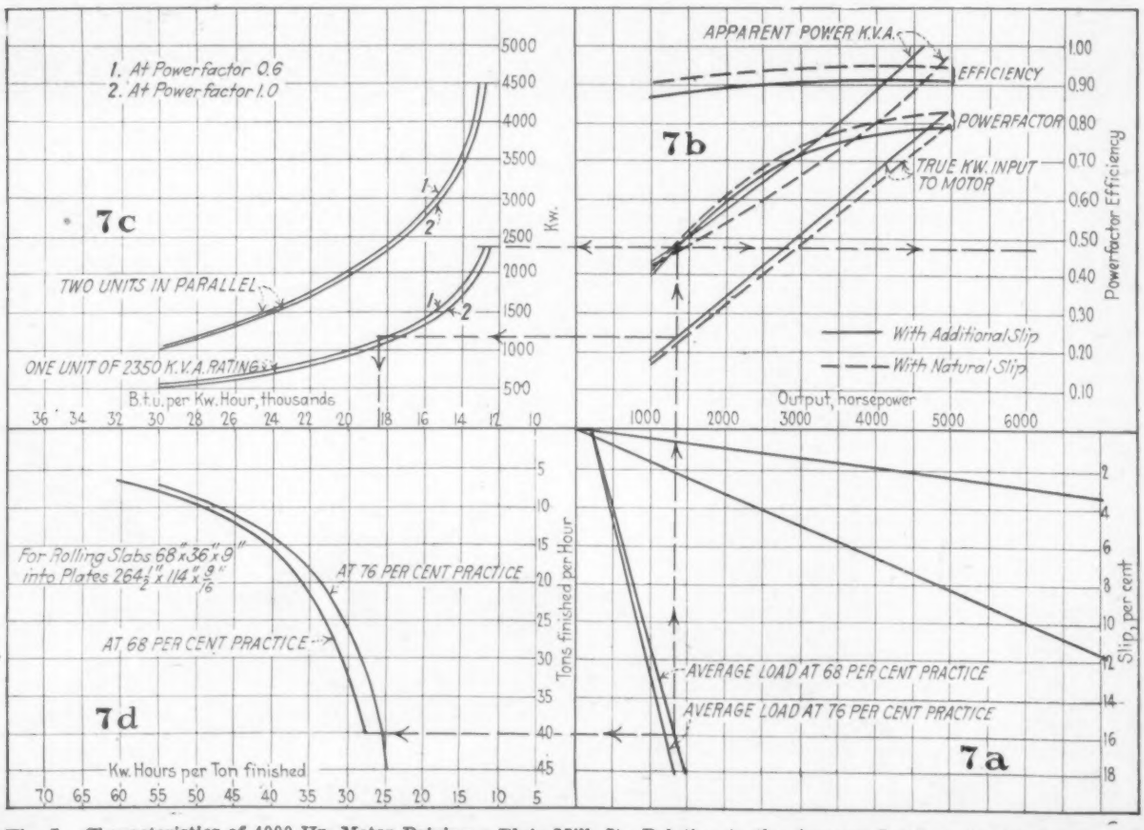

Fig. 7. Characteristics of 4000-Hp. Motor Driving a Plate Mill, Its Relation to the Average Load, to the Kwh. per Ton and to the Generating Units

power plant and on the economy of the drive at various loads, I have prepared Fig. 7 with four quadrants, 7a, 7b, 7c and 7d. The relation of the average load and of tonnage of finished product at 68 per cent and 76 per cent practice is shown in Fig. 7a. On the basis of the cycle in Fig. 5, the average load of 1312 hp. corresponds to 40.5 finished tons at 68 per cent practice.

Under the normal operating conditions, the finished tonnage and average load will be lower. The characteristic curves of the motor with a natural and additional motor slip and its relation to the power plant are shown in Fig. 7b, while Fig. 7c dwells on the function of power in kw. and the heat units in B.t.u. per kwhr., as required by one and two gas engine driven a. c. units, each with a rating of 2350 kva. To complete the various functions, Fig. 7d gives the relation of finished tonnage for 68 per cent and 76 per cent practice, and of kwhr. per ton, figured on the original computed stress diagram and on the characteristics of the motor. Curves in Fig. 7d check up very closely with data gained by meter readings. Fig 7a also contains the relation of the natural and additional slip and the output of the a. c. motor.

Following the arrow-marked line indicating the average load of 1312 hp., we note that the average corresponding input to the motor in true power is 1125 kw. at a low power factor, 0.47. This low power

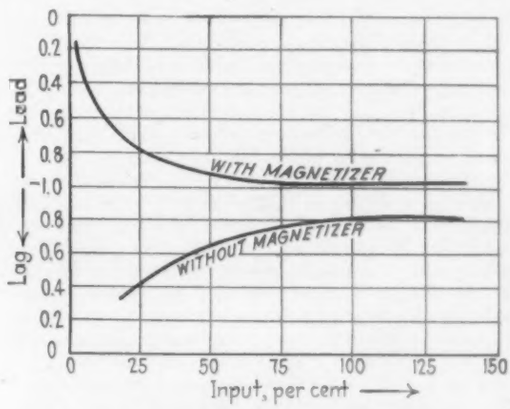

Fig. 8. Power Factor Diagram of Induction Motor, Showing Influence of Magnetizer

factor is, to the greatest extent, due to the variable and not uniform drafts of various passes. The corresponding apparent power is about 2400 kva., which is equivalent approximately to the rating of one generator. Since the load on the whole generating unit is determined by the rating of the generator in kva., the prime mover output (gas engine), is not available for the load from 1125 to 2400 kw., and must operate at 1125 kw., requiring considerably more heat units per kwhr., *i. e.*, approximately 18,800 B.t.u. These conditions improve with increasing load at the motor during the passes which are of short duration only. Under usual conditions, the wattless or reactive power is distributed on all generating units, also assisting each other in carrying the maximum power demand as governed by the diversity of the various load requirements.

Possible Improvements

Seeking for a means to reconcile the variable and partly indefinite stresses on the mill with an overpowering of the mill by the motors, no positive remedy can be given, but the observation of certain principles will alleviate such conditions. A careful analysis of the duty cycle expected from the drive and motor should be made. Frequently, it is possible to modify the mill practice to accommodate certain stock on a mill, stock which is of exceptional dimensions and which is rolled very seldom. Further, positive results may be obtained by a scrutiny of the roll practice for the purpose of adjusting drafts and of diminishing the maximum stresses, a field which is very promising of results.

There should always be equilibrium between the power demands on the power plant and the power supply to insure fairly constant frequency and voltage to keep additional unnecessary stresses away from the motor, due to the absence of such equilibrium.

Likewise, a good power factor will improve conditions. A small gain is afforded by the use of high-speed motors and of gears. However, still better results can be gained, particularly if the selection of a motor with a low average load and with high stresses cannot be obviated by the use of a magnetizer in connection with the motor. To my knowledge, there are none in use in this country, but I found on a recent trip that a considerable number were being installed in Europe, particularly in Germany. The magnetizer is a very small commutator machine which is driven either from the shaft of the roll motor or better by a small motor. The magnetizer is electrically connected with the slip rings of the roll motor and furnishes the magnetizing current to the roll motor. Several designs have been brought out on the European continent, but not all are suitable for roll motor service with flywheel. One type is a magnetizer with self excitation capable of producing a leading power factor at light load, as shown in Fig. 8 for a motor of medium output.

In conjunction with a roll motor and slip regulator, the latter is so set that it will step into action when a certain average load is exceeded. The excitation of the magnetizer is so adjusted that it will produce a leading power factor of the induction roll motor, from friction load to the average load, and from there on a slightly lagging power factor, depending on the slip of the induction motor. By this means, the overload capacity—pull-out torque—of the motor is enhanced and an improvement brought about on the line and in the power plant. Such an effect will be appreciated by referring again to Fig. 7a, b and c. With a power factor of practically 100 per cent the average load of 1312 hp. of the mill motor will demand only about half the generator capacity (1125 kva.) as compared with 2340 kva. demanded by a motor without a magnetizer.

Titanium as a Steel Alloy

The use of titanium as an alloying element for steel is much shrouded in secrecy. According to information supplied to the Bureau of Mines, carbon-free ferrotitanium has been employed in Europe for making an electric steel containing 5 to 7 per cent titanium. Rumors of the use of titanium alloy steels for armor-plate have been circulated, but so far as is known to the Bureau, no merit has been found in the addition of titanium to steel as an alloying element, and experiments with steels containing 0.10 to 1 per cent titanium have shown no special advantages. A more interpretative investigation than any so far carried out is required to distinguish more clearly the merits of titanium alloy steels, and it must be assumed now, pending exact proof to the contrary, that these steels are of no particular value, or at least yield no advantages not provided by other steels.

It is rather difficult to get the carbon-free ferrotitanium to alloy with steel without much loss of titanium and this fact, coupled with the high price of the carbon-free alloy, has tended to discourage experimentation by steel makers in this direction. It is possible, however, that if the cost were less, some combination of titanium, either alone or with other metals, might produce valuable steels for some purposes, and experiments need to be carried out. Titanium increases the hardness of steel, and experiments on titanium steels have been made by Guillet, Braun and Lamort. It has been shown recently by Gillet and Mack in Bulletin No. 199 of the Bureau of Mines that fair recoveries may be expected with carbon-free ferrotitanium, provided the alloy is added at the end of the heat and the steel is very hot. Complex iron-chromium-titanium alloys have been patented for use in making chromium steels—for example, 55 to 75 per cent chromium, 5 per cent titanium, 5 to 10 per cent carbon, and 34 to 10 per cent iron.

Managing for Future Conditions

Best Results from Combinations of Temperament—Selling Activity and Cost Reducing Inseparable—Dominant Buyers' Market Unlikely—Budgeting to Meet Market

BY STERLING H. BUNNELL*

THE time of the winter holidays and the exchange of calendars on the office wall forces the business man's attention to the forecasting of the prospect of the new year as compared with the year just ended. The result of last year's business may be good or bad; will the next year's showing be worse, or better? The amount of profit was, perhaps, normal and satisfactory; was it so because of smaller percentages but larger sales, or the opposite? Can next year's prices be increased, or can costs be reduced, and what will be the effect on the net result of the twelve months' period just starting? All these queries contain two opposite conceptions originating in a common neutral region,

IN all times, good and bad, reduction of cost and activity in selling are equally important.

like "top and bottom," "east and west," and all the other conceptions of opposites which have no definite point of separation, but shade imperceptibly into each other in the space between.

Cost Reducing and Selling Activity Equally Important

There is no way to separate such pairs of opposites, and to decide that a certain period is a time in which the reduction of cost is the major necessity, and activity in selling is of minor importance. In all times, good and bad, both activities are equally important. There can be no "top" without a "bottom"; no "up" without its contrasting "down." Neither is it possible to separate managing executives into the classes of forward-looking thinkers and impulsive "go-getters." Either of the two qualities may be dominant in one man, but successful management needs the well-balanced combination of both.

The cycles of business activity which were formerly vaguely appreciated by the business men of the nation are now clearly depicted to every man who will take the slight trouble to look at the charts compiled and published by the well known statisticians of trade. The wave curves of past increases and decreases are all on paper; the rise in prices, followed by the corresponding rise in production, has always culminated and gone on into a decline, with the production curve following a little in the rear.

Events may delay or hasten the progress of the movement, as one ocean wave overtakes and increases another, but events cannot stop or reverse the cyclic process. We have seen the effect of a great war in hastening the recovery from a severe depression (1913-14); and later, in impeding activity in certain lines (like the building of residences) so that a temporary boom rode on the back of the falling wave of depression which was bound to follow the peak prices of 1919, and made the final drop into the trough (in 1920) the more catastrophic. The main depression is now past; prices show a general tendency to strengthen; general improvement already appears. Will it proceed normally, or are there indications of a radical change in conditions which will require a change in tactics to deal with them successfully?

The most important factor in industry, the human element, certainly remains unchanged, as it has since the earliest evidences of human life. The totals of production and consumption must always be closely the same. Differences, however conspicuous, can exist only in a portion of the industries at any one time. We still have too many machine tools, made for war uses and now in process of slow redistribution among the factories which have need of enlarged facilities. We are short of many kinds of building material, and in consequence prices are high and deliveries slow. Food stuffs and textiles, like many other essentials, are not far from a normal supply.

Productive Efficiency and Sales Efficiency

Thus, there is manifestly at one and the same time a sellers' market, a buyers' market and a normal market. For the existence of predominantly a buyers' market, it would be necessary to suppose that the recent or present depression in this and other countries has had the unprecedented effect of making all men thrifty and sparing in their purchases. On the contrary, the habits of a life-time are not changed even by long periods of unemployment and want, so that people may be expected as before to spend their small change very nearly as freely as at any previous period.

Management in industry has at this time, as before, the same dual and indivisible problem—productive efficiency and sales efficiency. Opposite qualities are required for producing the best results in the two interdependent fields of work. Accordingly, we are familiar with the advantage of organization which includes the aggressive "go-getter" enthusiast to suggest

THE habits of a lifetime are not changed even by long periods of unemployment and want, so that people may be expected to spend nearly as freely as at any previous period.

and contrive and inspire, and the careful and critical conservative to weigh and select the best out of the other's prolific fund of resource. At no period can business generally succeed without the cooperation of both types; and the greatest corporations are those which have the best combinations of minds representing all phases of temperament. In times of improvement, the conservative wisely relieves the pressure on the brake, while always watching the rate of acceleration, ready to check the speed when the turn comes, and before depression begins within the factory as well as without.

Reduction in cost and promotion of sales are opposite means of reaching the same object—net profit. If in any given line of trade, demand is inactive, it cannot be stimulated by a reduction of cost; or even by a reduction of selling price, unless the prospective buyer can be found and the lower price forced into his observation. It may well be the easiest course to spend more effort and money in sales promotion, even with an increase in price to cover the additional expense. The price obtainable depends largely upon the amount of effort put forth in selling. Worthless gold "bricks" have been sold at a thousand per cent profit, and legal tender gold dollars have been refused when offered at fifty cents; all a matter of salesmanship.

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The manufacturer who produces a standard article at the lowest price has a powerful sales argument—but he cannot sell unless he makes the facts of price and quality known to the prospective buyer. No amount of thought and study by the management on the subject of reducing cost of production can be of any direct effect in making sales. If the sales of an industrial organization are satisfactory, it is because there is a successful sales plan in operation—or because the effects of a past plan are still in evidence. Decrease in production cost will provide a larger margin of gross profit, which should be in part devoted to further increasing the sales. The two functions, production and distribution, must always be considered together in any successful plan of operation.

THE progressive "go-getter" enthusiast suggests, contrives and inspires; the careful, critical conservative weighs and selects the best out of the other's prolific fund of resource. The greatest corporations have the best combinations of minds representing all phases of temperament.

Fixing Factory Cost to Meet Market Requirements

The only rational method of management of an industrial enterprise is to treat the two functions as indivisible as to importance. In the manufacture of automobiles, for instance, the first thing done is to decide on the grade of product to be made, and the selling price to which it is to be built. The system of discounts and selling expense schedule being established by the general custom of the trade, the factory net price is arrived at by calculation, and the percentage of desired profit is deducted to get at the factory cost. The car must now be built within that cost and as closely as possible to the allowed figure so as to give the most for the money available. What goes into one extra must come out of another, and so we find the purchasing department haggling over a 5 per cent discount in the purchase of a gasoline tank gage at 89 cents each, because the total cost of the components of the car is a few cents in excess of the figure of perhaps $427.75, and so some item must be bought cheaper. With such accurate budgeting, the manufacture of automobiles has grown to its present status of a permanent, reliable and important branch of American industry.

The same method ought to be applied to the operation of every manufacturing concern. The selling price should be fixed by considering what the public will pay. The selling cost to arrive at the desired volume of trade should be determined, if necessary, by consultation with trained and experienced sales development experts. The margin of profit desired should then be decided and the allowable cost of production computed. The manufacturing department is then in position to make its plans to produce at that figure with the least permissible outlay for equipment. Of course, the calculations and plans will have to be gone over two or more times so as to arrive by the method of trial and error at the final best solution.

IT is all wrong to have factories specialized so that some must shut down completely whenever expansion ceases. Articles always in demand because they are in constant use and must wear out and be replaced by new could be made to advantage by every metal-working plant.

It cannot be doubted that a large part of the fluctuation in the volume of trade of any industry is due to the thoughtless disregard of the necessity of constant inter-dependence of production and sales. The factory is led to expect always either feast or famine. When orders are plentiful, the producers are harassed by the effect of delays in shipping on time, and when the orders are scarce there is constant unrest due to fear of layoff or shutdowns. If behind on deliveries, the management rushes into increase of facilities, tying up money in fixed assets, when it would be better to put it into surplus and devote effort to increasing the sales of the most profitable items, and getting larger returns and better terms for the rest.

Most factories should in fact be run like their machines, to their capacity, and the established output should be sold on the best obtainable terms; leaving the question of increasing facilities by largely increased investment to be decided by other considerations than that some of the possible business is going to competitors. The best thing that can happen to a manufacturer may be the taking of business at an unsatisfactory margin by a competitor. More than one shrewd operator has permitted other concerns to load up with business taken at ruinous prices, and then skimmed the cream for himself.

Need of Thinking of Ultimate Buyer

The forward looking manufacturer should study today the general tendency to direct the sales effort to the ultimate buyer, and to let the distributer perform his proper function on a reduced margin. It may seem to be a great advantage to sell large quantities to wholesalers and jobbers, collect the cash or discount the paper, and turn the money back into the purchase of materials. But in times of stress, when the stocks in the middlemen's hands serve as a reservoir from which to supply the retail trade, the manufacturer finds himself without orders and with no possible source from which to get them. He has not even the possibility of borrowing money on his finished product to carry his organization through the slack period.

THE selling price should be fixed by considering what the public will pay. The manufacturing department must then make its plans to produce at the allowable cost.

The retail buyer, however, knows the least about depressions, and resumes his purchasing habits soonest. It is a severe business crisis that can long check the sale of cigars, pocket knives, razor blades, and the thousands of other items that are in everyone's home, office or pocket. The manufacturer who produces part of his output for the individual consumer has a backlog to keep him warm when business generally is burning low, and if he has made himself known by direct advertising so that his goods are called for and noticed by the public, he may hardly notice that times are bad.

Side Lines in Manufacturing

Manufactured goods may be roughly classified into those like machine tools and factory equipment, purchased in times of expansion to increase facilities, and those essential to daily life and so purchased through good and bad times alike. It is all wrong to have our factories specialized so that some must shut down completely whenever expansion ceases. Harvesting machines, motor cars, tools and implements are always in demand because they are in constant use and must wear out and be replaced by new. Some articles of this

class could be made to advantage by every metal-working plant. Then, in times of depression, sales effort concentrated on these lines would produce enough business to carry the concern through, at least without an operating deficit.

The factory manager who can and does look ahead will always have the advantage over the plodder who waits till the issue presents itself before he begins to plan to meet it; and over the "go-getter" who strains at the traces when he ought to back up and go around by the clear way. But the longest of far sight will never perceive any signs of radical change in the habits of the man who wants something for himself, as every man does. If the demand is not there, it is a waste of time to try to stimulate it. If the demand is there, but the buyer will not pay the seller's price, a cut may get the business for the seller who acts first; but if there is not enough buying capacity to absorb the total offering, a cut cannot produce normal business. On the other hand, if there is purchasing capacity—and there always is except at the very crisis of a depression—a better sales effort may get business at the regular price, and so greater cost of the sales effort will be justified. If the goods to be sold are of the class that is bought by the individual for his own use, or for his family or home, there is always purchasing power in limitless volume, and it only needs intelligent and adequate sales effort to meet it.

There need be no fear that manufacturers generally are not looking forward trying to discern future conditions and adapt their practices accordingly. A large proportion of factories have within the past two years taken up new lines of production and added force to their sales organization. Specialists everywhere are emerging from the ranks of sales manager and advertising man, who are distinguishing themselves by the results of the sales plans they have developed. Financiers have caused the reorganization of concerns on a budget system by which operating costs have been reduced to a minimum schedule, and sales increased according to a quota at a definite percentage cost. Distribution expense is being reduced in several ways, so that the manufacturer gets more of what the consumer pays. If the New Year brings a reorganization of European finance, so that international trade can be resumed and the enormous needs of the world for manufactured goods can be supplied freely, we may confidently expect that the curve of volume of business will rise as sharply and as far as the previous portion of the curve fell.

Ferroalloys and Hydroelectric Power

Power Factor and the Ferroalloy Industry—Importance of High Load—Natural Resources and the People

BY F. A. J. FITZGERALD*

F. A. J. FITZGERALD

THE manufacture of ferroalloys in the electric furnace is an industry of approximately 30 years' growth. During the last decade of the nineteenth century it was carried on in a very small way. Since that time its growth has been enormous and its vast importance became very evident during the Great War. The demand for ferroalloys such as ferrosilicon and ferrochrome was then so great that many plants sprang up under conditions that would normally be unfavorable; but because of the extraordinary prices paid for such ferroalloys, they met with more or less success. With the ending of the war and the subsequent great decrease in demand for ferroalloys these plants went out of business, the costs of manufacture being far too high and, in addition, over production resulting in a great drop in the selling price.

One of the largest items in the cost of manufacture of such alloys as ferrosilicon being that of the electric energy used, plants which were not situated where cheap power was available could not continue to do business. For certain ferroalloys such as ferrotungsten and ferromolybdenum the cost of power is a relatively unimportant consideration; but in the manufacture of alloys using raw materials that are cheap in comparison with the ores of tungsten and molybdenum the power item is a serious one. Thus it is that there is an intimate relation between the manufacture of such ferroalloys and hydroelectric power developments.

Hydroelectric and Steam Energy

Hydroelectric energy is not the cheapest form for all purposes, in spite of the cost-free mechanical energy of falling water as compared with the costly heat energy stored in fuel. There is another item in the cost of hydroelectric developments which in general is much greater than the similar charge which must be made in the steam-electric plant. In the steam-electric plant the largest item in the cost of power is that of fuel and consequently when the plant is shut down or when the load drops off, a great saving is effected; but under similar circumstances there is no saving in the hydroelectric plant, for the large item is the interest on investment which must be charged as though the plant

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THE author, a prominent American consulting electrochemist, contrasts the popular clamor for the benefits of cheap electricity from water power with the propaganda designed to discourage the reasonable use of such national resources as Niagara Falls. The American people are more dependent on electrochemical products than they realize. Demand for ferroalloys is increasing and the question is raised as to where the great quantities of cheap electric energy are to come from which are needed for the natural growth of the ferroalloy industry.

were running at full capacity. Therefore, to obtain the real benefits of hydroelectric energy the plant must be run at as nearly full capacity as possible.

In all electric generating plants the load factor, i.e., the ratio of the average load to the maximum load, should be as high as possible. Unfortunately, in nearly all uses to which electricity is put the load factor is very far from being 100 per cent. In a study made several years ago by E. W. Lloyd of the load factors of small and medium lighting customers in Chicago, he found that this varied from a minimum of 6 per cent, in small furniture stores, to a maximum of 26 per cent, in small hotels, and in a similar study of large consumers he found a maximum load factor of 75 per cent in fertilizer manufacture and a minimum of 10 per cent in grain elevators.

In general it may be said that the ordinary central electric generating station is doing well if it has a load factor of 40 per cent, and this can only be obtained where the central station manager makes a careful study of conditions and develops such a diversified market for his electric current that the maximum demands for current by the different users occur at different times, thus smoothing out his power curve.

Power Factor in Ferroalloy Plants

The great exception to this general rule of low power factor is found in electrochemical and electrothermal processes, where the load factor may be kept, indeed is in the well-run plant generally kept, anywhere between 90 and 100 per cent. In those ferroalloy manufactures in which the consumption of electric energy is large, the near approach to 100 per cent load factor is important for various reasons. The economical working of a large electric furnace requires the preservation of a constant load, because with a proper design of furnace there is a certain definite load at which the highest efficiency is obtained and any wide deviations from this load, either above or below, involve loss. In such ferroalloy plants the cost of electric energy being the largest or one of the largest items in the total cost of manufacture, it is necessary to keep this as low as possible, so that not only must the energy be used in the most efficient manner possible, but the price paid for it must be as low as possible and, other things equal, energy used at constant load can be obtained at the lowest price. This makes ferroalloy manufacturing processes an ideal load for a hydroelectric plant.

With the continually increasing cost of fuel the use of hydroelectric energy for household lighting and ordinary manufacturing processes becomes more and more attractive to the consumer; but the benefits to be derived are not so great as might first appear on account of the small load factor that is inevitably associated with such consumption of electric energy, and if the diversion of hydroelectric energy to these uses involves a shortage of the supply available for electrochemical and electrothermic purposes, which may be typified by the manufacture of ferroalloys, the ultimate consumer will suffer, since his interests are bound to be affected by any increase in the cost of ferroalloy manufacture, not to mention the great number of other electrothermal and electrochemical products which depend on cheap power.

Natural Resources and the People

There is a well-developed theory that the people of a country have an inalienable right in all its natural resources and therefore can properly control their distribution. How does this theory affect great hydroelectric developments like that at Niagara Falls and industries dependent on them such as the manufacture of ferroalloys?

There is a widespread popular belief among those living in a circle having a radius equal to the distance to which electric current can be transmitted more or less economically from a hydroelectric plant that it should be used primarily for the lighting of homes, for mechanical power for manufacturers, for farmers and so forth, and then if there is any power left over it might be sold to electrochemical industries such as that of the manufacture of ferroalloys. Now it can be readily seen that a policy of this kind may not give the consumer the cheap power he hopes to obtain from a hydroelectric plant because under these conditions the load factor will hardly be more than 40 per cent and perhaps much less. While it is true that the existence of electrochemical plants, having a load factor of over 90 per cent, will raise the load factor of the hydroelectric plant, if the ordinary consumer is in considerable preponderance the effect will be relatively small.

Cheapness Depends on High Load Factor

Since the cheapness of hydroelectric power depends largely on a high load factor it will be readily seen that under these conditions the small consumers cannot hope to benefit greatly. It must also be kept in mind that an important item of cost in any electric plant is that of distribution and consequently the consumers who use small amounts of electric energy compared to the large quantities used by consumers, like ferroalloy manufacturers, cannot expect to derive so great advantages from cheap hydroelectric energy.

Looked at from another aspect, this application of the theory of the rights of the public is fallacious, for the energy of falling water is useless until it has been converted into a form that can be transmitted to the consumer and unfortunately its economical transmission as electric current is strictly limited. When, however, that energy is transformed electrochemically, as in the manufacture of aluminum, or electrothermally, as in the production of ferroalloys like ferrosilicon, the area over which the benefits of the hydroelectric plant are distributed is enormously increased. Therefore, a true interpretation of the theory that our great water powers must be utilized for the benefit of all supports the contention that this can be most generally achieved by their extended use in electrochemical and electrothermal processes.

No one feels that he is being robbed of the benefits of our natural resources because immense quantities of coal are consumed in the manufacture of pig iron and steel, for he knows that without this consumption he could not get iron and steel products of all kinds, from bridges and tractors to pocket knives and needles; but he cannot see that these are also products of the ferroalloy electric furnace.

Dependence on Products Made with Electricity

This failure to realize our dependence on electrochemical products makes it also possible to secure an audience for those who oppose the utilization of great national resources like the falls of the Niagara River, for even when it has been demonstrated that far greater use can be made of these for power purposes than is now made, without in any way detracting from their scenic value, these misguided enthusiasts can convince the ignorant that such use is purely in the interest of selfish industrials of whom the ferroalloy manufacturer is a typical example.

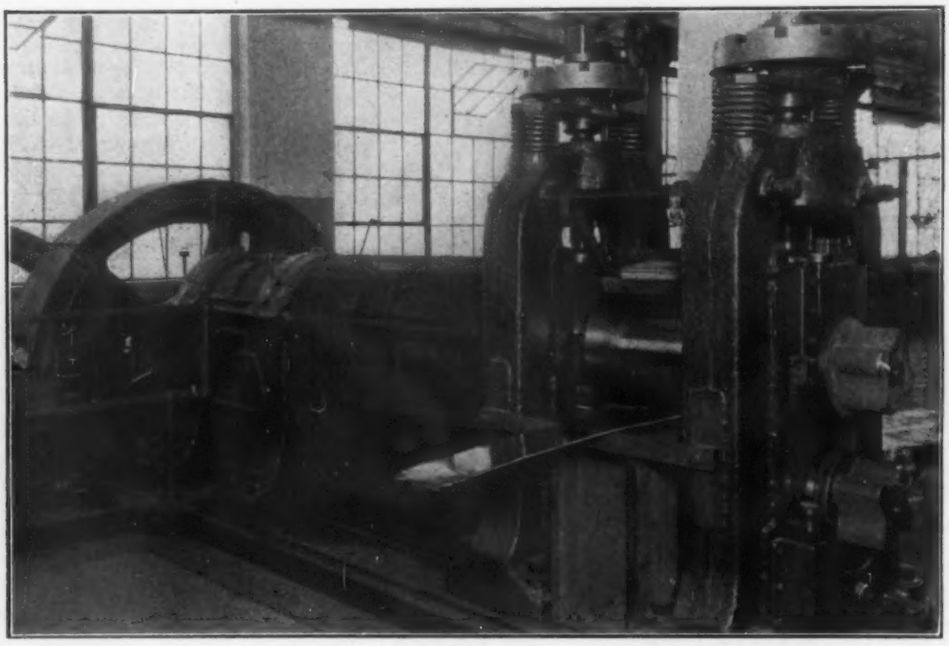
Thus with popular clamor, on the one hand, for the benefits of cheap electricity from water power developments and, on the other hand, with propaganda designed to discourage the use of water powers like Niagara Falls, it is difficult to see where the great quantities of cheap electric energy needed for the natural growth of the ferroalloy industry are to come from. No doubt the industry will grow, but the ultimate consumer may well pray to be saved from his friends' interest in hydroelectric development.

A Rolling Mill in a Pencil Factory

Rolling and Drawing of Precious Metals Among Features in Production Scheme of Wahl Company— Special Machinery Developed

BY GILBERT L. LACHER

IN using so common an article as a mechanical pencil one is not apt to visualize a rolling mill as an integral part of the factory producing it. A pencil is so small a metal product, comprising still smaller parts, that the problem of manufacture would appear to be primarily one of intricate fabrication. Yet apparent incongruities are often explained by necessity and such is the case with the Wahl Co., Chicago, maker of mechanical pencils and self-filling fountain pens. This manufacturer is a large user of gold and silver tubing. In fact, before the expansion of the mechanical pencil business little tubing was drawn from the precious metals. The need for it developed concomitantly with the demand for the Wahl product. When the company was operating on a small scale the tubing was furnished on contract by manufacturers of brass tubing. Subsequently the requirements of the factory increased so rapidly that it was decided that the company undertake to supply its own tubing. This step was taken for various reasons. One consideration, of course, was a saving in the cost of the tubing through the elimination of the profit which went to the mill. Likewise a steadier supply was insured both through the elimination of uncertainties as to deliveries and the greater responsiveness of a company mill to increasing needs of the factory. Furthermore, in the case of silver tubing it was possible to save the expense involved in the careful wrapping necessary to prevent tarnishing in transit from the mill to the factory.



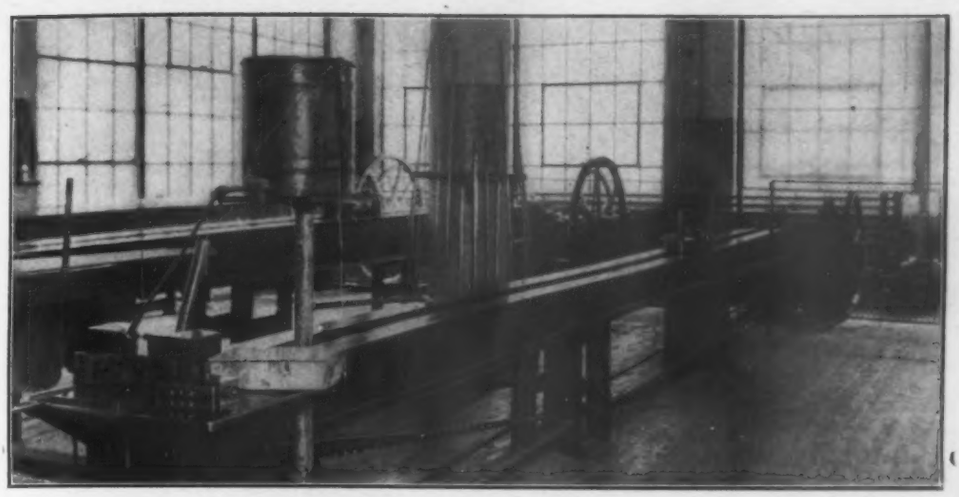
Slabs of 14- and 18-Karat Gold and Sterling Silver, as Well as Gold and Silver Plate, Are Rolled Down to Sheets in a Two-High Mill Running at 18 r.p.m. The mill has 16-in. rolls, 22 in. in length, and is driven by a 200 hp. induction motor with a constant speed of 435 r.p.m.

Solid and Plated Metals Rolled

The manufacture of tubing involves both rolling and drawing. For the rolling a two-high mill with 16-in. rolls 22 in. in length was constructed in the shops of the Wahl factory after the company's own designs. The mill is driven by a 200-hp. Western Electric Co. induction motor with a constant speed of 435 r.p.m. Both solid and plated metals are rolled. The former include Sterling silver and 14- and 18-karat gold, which are used for the company's finest products. An appreciably larger proportion of the company's output, of course, is in plated pencils and pens. In plating either silver or gold, the precious metal is soldered to a brass base, and owing to an unexplainable physical law familiar to most mill men, the proportion of the precious metal to the base remains the same no matter how finely the two are rolled or drawn. Pigs of silver and gold are melted in a crucible and cast into slabs. Brass slabs of the same face dimensions but of greater thickness are soldered to the gold or silver. Before the two slabs are joined together they are first thoroughly scraped to remove any dross, this being done on a scalping machine which has much the same construction as a shaper. The scalping tool on the reciprocating arm scrapes the surface of the slab on each draw stroke. The binding together of the two metals is accomplished by inserting a thin sheet of silver solder and then clamping the slabs together in a No. 5 Atlas mandrel press. To permit a thorough fusion of the solder with the two adjoining metal surfaces the slab is placed in a crucible which, because of its use, is termed a plating furnace. The next step is to roll slab, now 1 x 4½ x 14½ in., in the 200-hp. mill. The speed of the rolls is brought down to 18 r.p.m. by means of heavy reduction gearing. Here the slab is reduced in thickness to 1/10 in., its width being increased to 7¼ in., and its length to 7½ ft.

Sterling silver and 14- and 18-karat gold are rolled in the same manner, except that smaller slabs are used. Whether the sheets produced in this mill undergo further rolling or are drawn into tubing depends on the pencil parts for which the material will be used. The tubing is used for the pencil barrel as well as the cylindrical portion of the cap. For the clips which fasten the pencil to the pocket and the "tasse," or top of the cap, flat sheets are used. Likewise tubing is used for the barrels of pens and flats for clips, inner barrel ends and cap tasses. For pen points, or "nibs," 14-karat gold flats are used exclusively.

For the manufacture of tubing disks are stamped out of the sheets. The disks are drawn into tubular



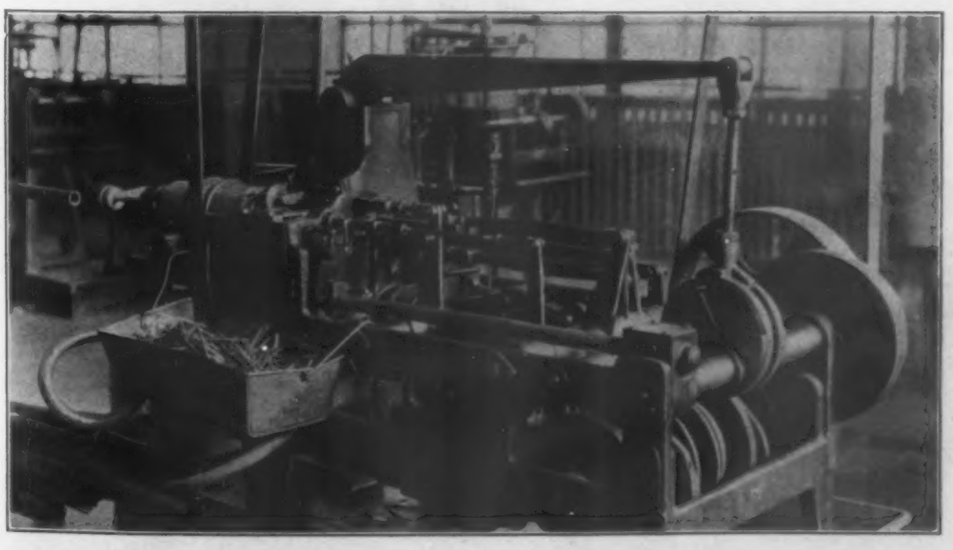
Two Motor-Driven Presses, Shown Below, Stamp Disks Out of the Gold and Silver Sheets, and Then Draw the Disks Into Tubular Form. A battery of 12 draw benches, one of which is shown at the left, draw the gold and silver tubing down to the final sizes.

form over dies in a battery of two motor-driven No. 60½ Bliss presses. The metal must be annealed between each drawing and for this purpose three gas-fired furnaces have been provided. When the tubing has been drawn to 0.07-in. gage, with 1.24 in. inside and 1.38 in. outside diameters, it is conveyed to the floor above where it is drawn down to the final sizes desired. There are 12 draw benches, all built by the company, in which the tubing is drawn. A pointing machine swages the end of the tube so that it may be securely held by the jaws of the gripper on the bench. The cross-section of the tubing is reduced as it is pulled through successive dies. Annealing is necessary between drafts and prior to each annealing the tubing is immersed in a solution of French ochre and boric acid to protect the metal from what are termed "fire marks."

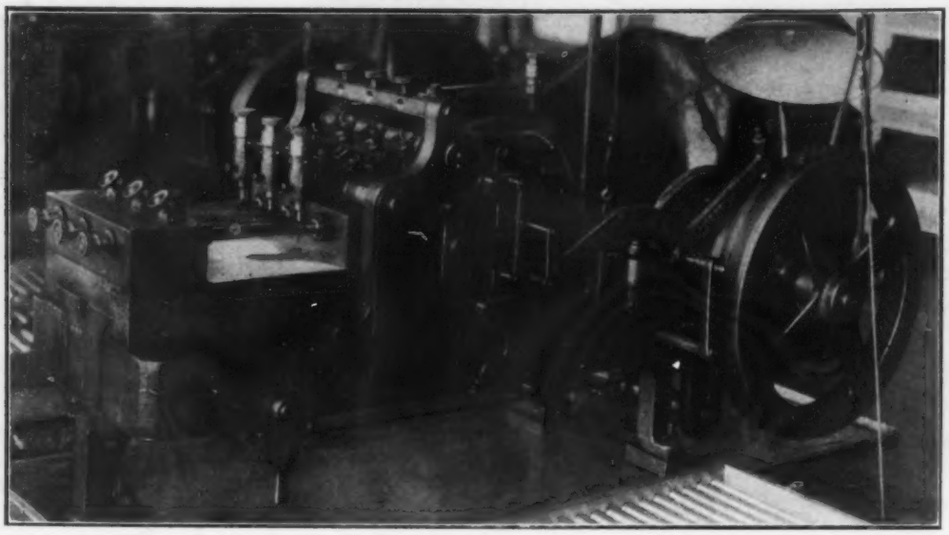
On the same floor with the draw benches are two two-high mills, also built by the company, which are used to roll flats to the thickness desired for stamping out clips, tasses, nibs, etc. One of the mills has 6 x 8-in. rolls and the other 8 x 10-in. rolls. Both are driven by 40-hp. 575 r.p.m. Western Electric Co. induction motors, gear reduction being used to bring the mill speeds down to 42 r.p.m. The same precautions as to annealing must be observed in the rolling as in drawing.

To one familiar with the rolling of baser metals it may seem strange to place rolled and drawn products under lock and key at the conclusion of each day's work. Yet that is exactly what is done here. Not only tubes, but sheets and slabs, no matter in what stage of reduction they may be in, are all stored away in a vault for protection against theft.

Obviously demand for pencils is not confined to the more expensive models which are made with silver and gold barrels. In fact, the major part of the factory's output is in the cheaper pencils with barrels of brass, coated with silver by electrolysis or enameled. Most



A Single Machine Automatically Forms, Cuts and Punches the Tubing Which Constitutes the Magazines Which Hold the Pencils' Reserve Supply of Lead. Tubing is fed into the machine from a long pipe held horizontally on the standards



The Engine Turning Machine Engraves a Number of Pencil Barrels Simultaneously. The carriage reciprocates while the engraving tools pass over the barrels, and the tools are relieved or pressed down according to the contour of the actuating cams. Through the use of different cams a wide variety of designs can be produced on the same machine.

of the mechanism is also made of brass, including the inner barrel, the lead magazine, the ends of the magazine and the eraser holder. All of these parts are made of tubing except the ends of the magazine which are automatic screw machine products. The factory's consumption of brass tubing is great; in fact, the Wahl Co. is the second largest user of brass tubing in the country, being outstripped only by a leading maker of automobiles.

Construction of Barrel, Clip and Magazine

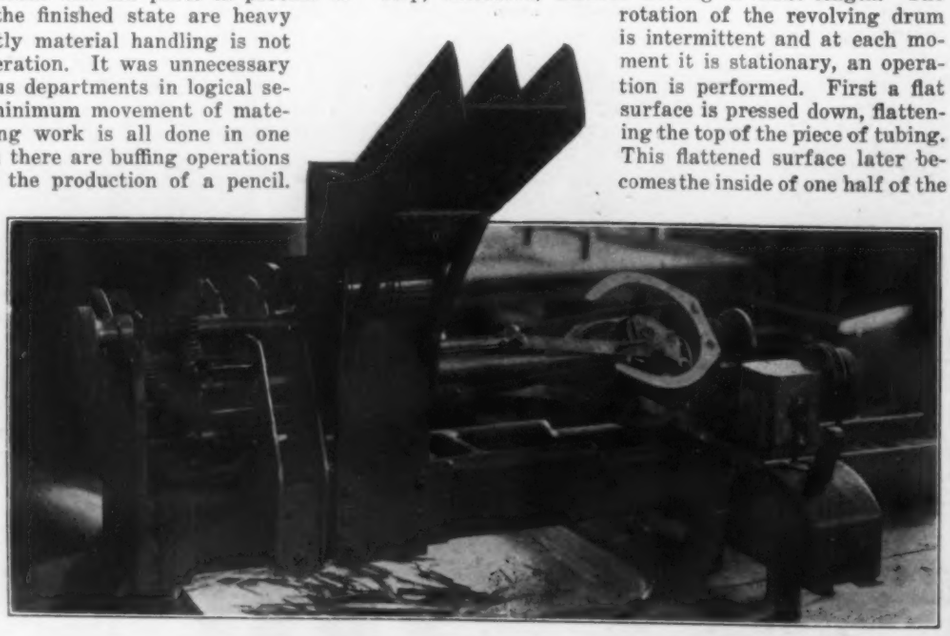
The inner barrel just referred to serves a double purpose. First it makes unnecessary the soldering of the clip to the outer barrel. The clip is so stamped that it has fins which are passed through a hole punched in the outer barrel and are wedged tightly between the outer and inner barrels when the latter has been inserted and soldered into place. After the barrels have been jacketed one over the other and the solder has had an opportunity to solidify, the inner barrel is tapped with threads to engage the nut on the end of the plunger which expels the lead from the pencil. The nut and plunger are automatic screw machine products, the nut being of brass and the plunger of phosphor bronze.

The magazine which holds the reserve supply of lead is formed, cut to length and punched on a special manufacturing machine built by the Wahl company. At this point it might be mentioned that the production problem of this factory differs materially from that of many other plants. The product contains few parts so that it is unnecessary to provide an elaborate system for keeping track of raw and finished material stocks. Neither the raw material nor the parts in process of manufacture or in the finished state are heavy or bulky; consequently material handling is not an important consideration. It was unnecessary to arrange the various departments in logical sequence to insure a minimum movement of materials. In fact, buffing work is all done in one department, although there are buffing operations at various stages in the production of a pencil. Neither was it essential to locate the shipping room on the first floor where it would be convenient for loading cars. While the output of the company is large, the individual product is small and practically all shipments go out either by mail or express. The shipping room, in fact, is on the top floor.

Production Machinery Designed and Built

The main problem of the Wahl Co. has been to provide machinery to do work which was formerly done by hand. This was rendered difficult because equipment had to be provided where none existed before, owing to the youth of the industry. Furthermore, the mechanical pencil consists of intricate parts which must fit together accurately to permit the finished product to operate. This explains why the Wahl plant has an unusually large and well-equipped tool room and a drafting department, where labor-saving machinery is designed and manufactured.

Prominent among the production machines which have been built by the company is the machine previously mentioned which automatically forms, cuts and punches the magazines which hold the pencil's reserve supply of lead. Tubing is fed into the machine from a long pipe held horizontally on standards. With each stroke of the grippers a rapidly revolving disk saw is lowered and cuts the tubing to length. Simultaneously the end of the tubing strikes a stop which opens up a vent through which the piece drops into a notch in a revolving drum. In case the tubing does not engage the stop, the vent remains closed and the piece cut is passed by the chute to a scrap basket in front of the machine. The stop, therefore, insures cutting to exact length. The rotation of the revolving drum is intermittent and at each moment it is stationary, an operation is performed. First a flat surface is pressed down, flattening the top of the piece of tubing. This flattened surface later becomes the inside of one half of the



The Magazines of the Pencils Are Charged With Leads by Special Machines. From a double chute and hopper the leads pass to a counting drum, then to a rotary conveyor and finally to gathering troughs from which they are pushed by a double acting plunger into the two chambers of the magazine

magazine, the final cross-section of each half being crescent-shaped. In the next operation a forming plunger is inserted into the piece while a die is pressed against the outside, giving the piece its final form. Finally the piece is pushed out of its notch in the drum and passed under a punch for punching, following which it drops through a hole in the pan of the machine into a basket. Two of these pieces joined together form the magazine in its final form. The magazine, therefore, has two cavities—one in each piece of tubing—to hold the reserve supply of leads for the pencil. To take care of the various operations of the machine, all of which must be accurately timed in relation to each other, 26 cams have been arranged on the pulley shaft. There is a battery of forming machines which produce all the magazines required by the factory.

Among other production machines developed may be mentioned the engine turning machines which produce the ornamental designs on the surface of the pencil barrels. These machines are multiple in operation, engraving a number of pencils simultaneously. The carriage holds three pencil or pen barrels and reciprocates after the fashion of a planer bed while the engraving tools pass over them. The tools are relieved or pressed down according to the convolutions of cams which they engage and after each stroke of the carriage the barrels automatically rotate until their entire surfaces have been engraved. Through the use of different cams a wide variety of designs can be produced on the same machine.

For drawing the end of the pencil barrel down to a point a swaging machine has been built. Ingenious machinery has been devised likewise for the manufacture of pens. In previous practice, rubber barrels were turned on a lathe, but the presence of sulphur in the rubber quickly dulled the tool and necessitated repeated time-consuming sharpening. At the Wahl plant this work is now done automatically on grinding machines. The rubber barrels are fed to the grinders by magazines so that the only labor involved is charging the magazine. The grinding wheels on some of these machines are vertical and in others diagonal so that all marks of the wheel on the surface of the rubber barrel are successfully effaced.

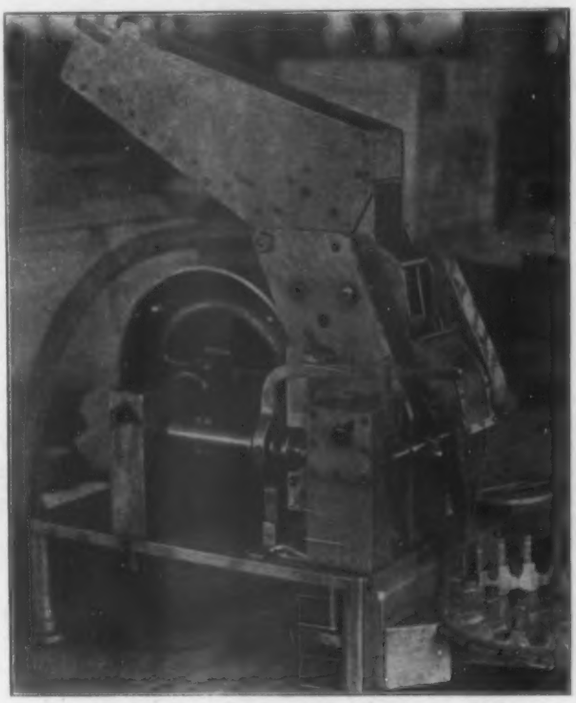
Labor Saving Machines for Assembly Operations

Labor-saving machinery has also been built for the assembly operations. One of the most interesting machines automatically charges the magazines of the pencil with leads. The leads are fed from a double hopper to a double counting drum, receiving two leads end to end in a notch at one time. From the drum the leads are dropped onto a rotary conveyor, which in turn discharges them two—end to end—at a time into a double gathering trough on the main shaft of the machine. Six leads, two sets of three end to end, are collected in each trough. The magazines are fed into notches on two parallel revolving disks. From the notches they are forced on sprockets on the main shaft of the machine, the sprocket passing between the two halves of the magazine, which is sprung out sufficiently to take a firm grip on the sprocket. When in the rotation of the shaft, which is slow, the ends of the two chambers of the magazine are directly in line with the two gathering troughs, a double plunger operated by cams pushes the leads into the magazine. One plunger arm introduces the bottom layer of six leads, three in each chamber of the magazine, and immediately thereafter the other arm pushes the remaining six leads into the chambers. Short pencils are charged with only six leads. In filling them one of the plunger arms of the machine does not function, as the leads which are introduced into the chambers of the magazine correspond only to the bottom layer in a large sized magazine.

Machinery has also been provided for packing leads in small tins for general sale to pencil users. There is a series of these machines, each operated by a girl who inserts the empty tins which are then automatically filled with leads and capped, following which the tins are carried along on a belt to a point where a final assembling machine gathers together a group of tins and charges them into a larger carton. The tins, incidentally, are automatically made on punch presses.

Pencil Parts Frequently Inspected

One of the heavy expenses of the plant lies in inspection. Pencil parts must be frequently inspected at various stages in the operation to make sure that work is being done within the necessary limits. Without this painstaking inspection thousands of parts might be made which would not fit together. As a result of the system, extraordinary care is taken in some of the machine operations, as illustrated by the broaching of the pencil tip. The broaching of the inside of the tip is necessary to prevent the lead from rolling during writing. The broach is forced through the tip on a hand press, but inasmuch as the effectiveness of the tool is destroyed by clinging metal turnings, no matter how small, it must be washed after each operation. Another outstanding example of exceedingly careful workmanship is the grinding of the gold nibs in the pen department. Emery, carborundum and alundum are used as abrasives and so smooth a surface is required on the nib that the best production per man per day is 125.



Machinery Has Also Been Provided for Packing the Pencil Leads in Small Tins for General Sale to Users of Mechanical Pencils. Empty tins are automatically filled and capped

The few operations cited are typical of the exacting requirements of pencil and pen production. Accurate and skillful work, of course, can be done only in the best of light, and from the point of view of illumination the Wahl plant is a model in construction. The building consists of four parallel rectangular wings separated by six courts, three on each side of the main connecting trunk of the structure. The floors and frame-work are reinforced concrete and the walls are of continuous sash with brick trim. The result is a maximum of daylight in all parts of the factory.

Adequate light is essential in most manufacturing processes but it is seldom that it is considered necessary to control atmospheric conditions. Yet this has been done in the assembling department of the Wahl plant to protect the silver from tarnishing. All air supplied to the room is dehydrated and then cooled to the desired temperature by means of Carrier Co. refrigerating equipment. As an additional precaution the assemblers are required to wear gloves so that the silver is not attacked by the acid in the perspiration from their fingers. The final wrapping of the pencils is in a

special paper called "glassene" which is air and moisture proof.

Lead for Pencils Also Manufactured

In the assembly department as well as in all other sections of the plant one is impressed by the comprehensive measures taken to meet all possible contingencies. The self-sufficiency of the factory, so strikingly illustrated by the metal rolling and drawing equipment, is no less evident in the lead department. The lead for pencils which, as is generally known, is a mixture of graphite and clay, is manufactured according to secret processes. So carefully are these formulæ guarded that the heads of leading European pencil factories personally mix the lead constituents behind locked doors. When the lead needs of the Wahl factory rapidly mounted, some difficulty was encountered in obtaining an adequate supply and for this reason it was decided to install a lead department. Much laborious and disappointing experimentation followed, but finally successful formulæ were worked out. Both foreign and domestic clays are used in the mixtures, the former for the more expensive leads and the latter for a cheaper product. Following the mixing of the materials the lead is forced through dies by hydraulic presses of the C. F. Elmes Engineering Works, emerging in long strings. A motor-driven manipulator operating beneath the dies causes the strings to be deposited in coils. The coils are later cut and arranged in straight grooves on flat plates which are then inserted into gas-heated furnaces where the leads are dried at a high temperature. Colored leads are also produced.

Confronted With Seasonal Market

Enough has been said to indicate that mechanical pencil manufacture has been put on a broad production basis. The most economical production of any commodity, however, can be obtained only with relatively steady employment of men and equipment. The pencil manufacturer is confronted with a seasonal market. While there is a fairly steady sale of cheaper pencils, the demand for the more expensive models is predominantly in the Christmas season. It might be thought that this demand might be anticipated with sufficient accuracy to permit fairly even production throughout the year. This is prevented, however, by the fickleness of popular fancy. Fashions in pencils change as rapidly as modes in any other article of jewelry. Whether a highly ornamented barrel or one with a plain, severe design will be in demand cannot be determined in advance. The effect of this situation on production is that out of the company's output of approximately eight million pencils annually, fully 75 per cent are manufactured in the last six months of the year.

The Wahl factory is five stories in height and its overall dimensions, ignoring the courts, are 125 x 475 ft. The plant employs 1500 people when operating at full capacity.

Electrical Developments During 1922

The most important general aspect in the developments in electrical apparatus was the increase in size and guaranteed efficiencies of power generating and distribution apparatus, according to John Liston, General Electric Co., Schenectady, N. Y., in a review of the electrical developments of 1922. Other noteworthy characteristics were the growing use, and increased capacities of automatically controlled stations, the increase in the electrification of railroads, especially abroad, and the advances in street lighting in this country. In addition, many improvements have been made in the existing forms of electrical apparatus of all sorts, and several varieties have been brought out.

In line with the tendency to increase the size of individual units for generating electric power, the maximum rating for steam turbine generators was increased to 62,500 kva. The size of waterwheel generators was also increased, one for 65,000 kva. being built for the power developments at Niagara Falls.

The renewed activities in hydro-electric development and the expansion of central station equipment resulted in an unprecedented production in transformers of all classes, as well as a considerable increase in the average size of those produced. The average size of all types of the units produced in 1922 was about 1000 kva. greater than the average for 1921. Seven water cooled 80,000-kva. units under construction for use on 220,000 volts are the largest physically ever built. There were also many new developments in what may be termed transformer accessories, and paralleling the increase in size and capacity of generating and transforming apparatus has been, of necessity, the development of larger and improved forms of switching devices. A large number of new relays for various purposes were designed during the year, both for protective and operating purposes.

Important advances were made during the year in the size, number installed, and expansion of fields of application of automatic control equipments. While the greatest use was in railway work the same facts apply to those used for the control of hydro-electric generating plants, motor generator stations for mine and industrial use, and in fact practically all phases of generation and distribution. The largest fully automatic single unit hydro-electric station, consisting of a 5000-kva., 2300-volt, 60-cycle, waterwheel generator went into operation during the year on the lines of the New England Power Co. Two new developments have greatly aided in the expansion in the use of automatic control equipment, one of which is the automatic reclosing equipment, and the other, the supervisory control systems developed.

Renewed interest in railway electrification throughout the world was a feature of the year. The electrification of existing steam roads, was, however, largely confined to those in foreign countries. In the United States electrification projects under way or contemplated include that of the Illinois Central, and the Baltimore & Ohio Railroad. Two sample 1500 volt d.c. locomotives were also shipped to Japan during the year. The trend of ornamental street lighting has been to extend it to residence sections, parks, and boulevards, instead of confining it to the business districts as formerly. More street lighting material of all sorts was purchased and installed during 1922 than in any previous year. The lighting of highways received renewed impetus. Several developments in the application of electricity to various industrial processes took place during the year. Of these, one of the most important and timely was the electric steam generator, which consists of a compact, self contained unit, containing a lower section, or hot well, and an upper chamber where the steam is generated by the passage of electric current through the water from three large iron electrodes suspended from the roof. Water is continually circulated between the hot well and the generating chamber by a small motor-driven centrifugal pump. The operation of the steam generator can be rendered practically automatic by means of this pump and an automatic feed water regulator. The outstanding characteristics of the device are safety, and economy, the latter especially in the case of industrial plants generating their own power hydro-electrically, or buying it on a maximum demand basis. Another development was a new form of synchronous motor, for high starting duty. It is constructed so that it is possible to bring the armature, which is normally the stator, up to speed without reference to the load, and then, when it is up to synchronous speed, to apply field, as usual, and bring the rotor up to speed gradually. By this method torque is applied gradually and the driven machine is started without shock.

A new type of induction furnace for melting brass and other non-ferrous metals was also brought out during the year. A new design of 400 amp. constant potential arc welding set, with three resistors, two for metallic arc and one for carbon arc, welding; a portable variety of the semi-automatic arc welding outfit, and a new motor driven general purpose hoist having a capacity of one-half and one ton respectively, were among other developments.

Chemical Methods of Iron Ore Purification

Steps in Experimental Work Carried on for 20 Years—Separation of All Ore Ingredients in Pure Form—Small Plant Now in Operation in Delaware

BY A. J. MOXHAM

MR. MOXHAM was president of the Johnson Co., which for a good many years operated a girder rail mill at Johnstown, Pa. In 1894 the company decided to make its own steel and built a Bessemer steel plant at Lorain, Ohio. Under Mr. Moxham's management it expanded greatly, becoming in 1898 the Lorain Steel Co., which built blast furnaces and a by-product coke plant. On the formation of the Federal Steel Co., which bought the Lorain Steel Co. in 1899, Mr. Moxham retired from the company, later going to Sydney, Nova Scotia, as president of the Dominion Iron & Steel Co. and building its blast furnaces, steel works and coke ovens. After a number of years at Sydney he became associated with the DuPont interests at Wilmington, Del., and while in that connection he took up the investigations of which some account is given in the accompanying article.

IN 1894 a 60 per cent ore mixture was easily obtainable for blast furnace use. Today a 50 per cent mixture is harder to get. The average iron content of Lake ore is declining at the rate of from one-third to one-half of 1 per cent per year. In the meantime progress is offering an ever-increasing premium for greater purity in iron and steel. So the demand for increased purity in the finished article is being met by a continually decreasing purity in the ore. This is an illogical evolution.

A realization of this situation led the writer to start a study of the problem in 1902. This study has continued without intermission and has now covered 20 years. As much ground has been covered, the following history of the effort gives only the high points.

Physical Methods of Concentration

The methods first tested were purely physical and typified by the ordinary washer, ending with the jigs and tables of the time. The ore selected was the Oriskany ore of Virginia, selected because ultra low grade. A long series of accurate tests with large product followed and the results as given below were both surprising and discouraging:

Table I—Concentration Test on Large Tonnage

	Crude Ore, Per Cent	Concentrates, Per Cent
Iron oxide	*44.300	†61.430
Alumina	5.550	2.400
Silica	42.355	24.780
Manganese	0.625	0.835
Phosphorus	0.235	0.312
Lime	0.236	0.202
Magnesia	0.015	0.015
Sulphur	0.023	0.030
Zinc	0.181	0.241
Combined water	6.500	9.950
	100.010	100.195

*31 per cent Fe. †43 per cent Fe.

But this concentration imposed a loss of 40 per cent of material, the efficiency being only 60 per cent. With improved jigs we reached a concentration of 47.50 per cent iron, but with a still greater reduction in the efficiency. It fell to 40 per cent, a loss of 60 per cent of the material being sustained. A series of microphotographic studies finally satisfied us that effective water separation of this ore could not be achieved by the jig method, because the admixed silica was so fine that to separate it demanded an extreme pulverization, under which condition the surface tension in any water method would be too great a disturbing element for the proper operation of gravity. This brought us to 1907. Reluctant to give up physical methods, we next tested the behavior of heavy specific gravity liquids, utilizing for this work the haloids —hence the

Haloid Method of Separation

We got excellent results with antimony bromide by the haloid hot process, so named because the Oriskany ore, being a limonite, had its combined water driven off by calcination. The increase in iron content by concentration with this process was as in Table II.

As a matter of economy we gave up the calcination and adopted a cold process. We used tin bromide with success. It gave us from the same Oriskany ore a concentration of 55 per cent iron. This was equivalent to 60 per cent with the water eliminated. The efficiency also was equal to that of the hot process. The recovery of the reagent (tin bromide) was 99.50 per cent. For days at a time the bromide left in the ore was only a trace.

Coal Separation

For coal we used tetra-chloride of carbon and got such results as the following:

Dayton coal, Tennessee—Ash reduced from 21.48 per cent to 6.5 per cent and sulphur reduced from 1.29 per cent to 0.85 per cent with 78.7 per cent efficiency. In another sample ash was reduced from 20.42 per cent to 6.2 per cent and sulphur from 1.35 per cent to 0.86 per cent, with 83.8 per cent efficiency.

Anthracite culm from the Exeter dump had its ash reduced from 45.21 per cent to 4.43 per cent.

Dominion coal at Sydney had its sulphur reduced from 1.77 per cent to 0.96 per cent in the coke and another test gave only 0.65 per cent in the coke.

Table II

	Crude Ore, Per Cent Fe	Concentrates, Per Cent Fe	Per Cent Efficiency
Oriskany ore, Virginia	31.00	60.00	85.00
Clinton ore, Alabama	34.20	53.32	75.50
Dunderland, Norway	29.63	66.36	88.70
Florence ore, Lake Superior	46.00	54.26	92.30
Port Henry, New York	35.00	68.50	98.10
Moose Mountain, Canada	40.00	61.36	89.50

We succeeded in ridding Rhode Island coal of its graphite. The loss of the reagent was nearly negligible; it was lower than with the ore. Success had been reached as to the separation. We were also encouraged to hope for a tangible reduction in the cost of the reagent and were well started in this study when the world war in 1914 stopped our supply of bromide and hence pro tem our efforts.

Separating All Ore Ingredients

In the meantime our work had taught us something about chemistry. Our ability to recover the reagents with a minimum of loss had given great hopes of a low

operative cost. The principles that governed the work were also promising. We early realized that the logic of a chemical method would lead to the separation in pure form of each one of the ingredients in the ore with great purity, instead of limiting the work to one ingredient only, and when pure each ingredient had large value. To illustrate: In Oriskany ore at current rates the value of all the ingredients is about three times as much as would be the case if the old method of getting out only the iron oxide was followed. This, even assuming 100 per cent efficiency for the concentration of the oxide. Taking 80 per cent efficiency it would be about four times as valuable.

With the low grade New Jersey ore on which we are now working the ratio of value becomes as from 7 to 1 to 9 to 1. The relationship will vary with difference in analysis. It would take a phenomenal increase in cost to neutralize this increase of value. So while awaiting the war's end we continued our work by the purely chemical method. The war only hastened this result, however. The logic of events had headed us that way. We believe we have now reached a decision.

The Chemical Method

Omitting the fringes there are three main steps:

1. Leaching with sulphuric acid with recovery of the acid.
2. Calcination with carbonate of soda, with recovery of the carbonate of soda.
3. Reduction of the oxide and subsequent melting.

THE ACID LEACH

Enlarging on each step, we take up first the acid leach. The finer the ore, the quicker and more efficient the leach. With reasonable fineness it is possible to leach with a 90 per cent efficiency in four hours. We can leach 60 mesh material with 95 per cent efficiency in six to eight hours. The equation lies entirely between the cost of fine crushing versus the value of time.

The recovery of the acid by the gas calcine is secured by heat. In this the temperature is finally brought up to 650 to 700 deg. C., although, as the reaction starts at 167 deg. C., the great excess of the SO_3 gas is driven off at much lower temperature. A full volume of heat in the early part of the reaction, accompanied by constant agitation as the heat runs up at the end, leads to thorough recovery. The oxide is obtained with not more than 0.02 to 0.03 per cent of sulphur remaining. The reversion from SO_3 gas back to the SO_2 that occurs at over 600 deg. C. is less than one-fourth of 1 per cent in our method and the acid is recovered as a very highly concentrated fuming acid at an increased value per ton.

THE SODA CALCINE

With good agitation (which is a sine qua non in every step in the process), the time needed will be from five to six hours. The step recovers all phosphorus, bringing it down to 0.03 per cent. It also eliminates remaining sulphur, the final oxide rarely having more than 0.01 per cent. It takes care of any silica left, our tests showing a reduction to 0.06 SiO_2. Lime and magnesia are thrown out completely. The soda calcine is the perfecting of the purification. For instance, if the oxide be semi-fused for use in the blast furnace, all product would be low phosphorus pig. But it also gives us all the alumina as a sodium aluminate, which is effectively leached out and then recovered by passing through it the same CO_2 gas that is driven off and recovered in the soda calcine. The alumina is pure.

The recovery of the carbonate of soda takes place during the passage of the CO_2 gas while precipitating the alumina. The method is standard.

REDUCTION OF THE OXIDE

The reduction of the oxide and thereafter the melting are also a solved problem. The finer the oxide the quicker and more thorough both the reduction and melting. By certain manipulation in the gas calcine we can make it excessively fine. It is expected to finish the melt with electricity, even if only to control the proper liquation of the slag. The zinc will be given up in the form of zinc oxide during the reduction, the reaction being the same as that which now occurs.

Purification Before Steel Making

Our research records naturally contain some novel developments and heretofore unconsidered reactions, but as the process was based originally upon the realization that chemical knowledge has outstripped its application to steel, there existed no need of adding to chemical reactions already existing in excess. In its final analysis the method is an acid leach followed by an alkali treatment. The most vital part of the study was in the achievement of group reactions whereby every one of the ingredients is purified and separated instead of operating upon one ingredient only. In steel making today chemical change accompanies the whole technique of manufacture and final purification is only completed as the steel reaches the final stage. It utilizes costly machinery, such as the blast furnace, converter and open-hearth furnace as purifying tools, and is accompanied by much labor and waste. We believe this is purifying at the wrong end. Our method is to complete all of the purification at the other end and to carry it to its finish in one operation entirely by chemical reaction. In our method we aim to complete all of the purification before beginning the manufacture of the steel.

Equipment

The mechanism will consist of a sectional kiln of indefinite length. Each section has its specific work to perform and is capable of a different speed and a different heat adjustment, but all are continuous.

A gas seal where needed avoids any waste of valuable gas, as in the case of the sulphuric acid recovery and that of the pure carbonic acid. The heat flows through the continuous kiln commencing at the hot delivery end at perhaps 1200 deg. C., and escaping over the incoming ore at the cold end at only 100 deg. C. As the material flows through the kiln, the respective purified products deliver at right angles, while the sintered oxide or molten steel (as may be desired) continuing its path is delivered at and through the hot end. The flow is automatic and only involves the labor cost of supervision. The method and experience of cement manufacture will govern throughout.

It should be emphasized also that the acid is recovered in ultra concentrated form, even as fuming acid if desired. It is used in its cheapest form (chamber acid), and after performing its work it is recovered in its most costly form. This profit should nearly if not quite cover the whole cost of the process and all the purified ingredients be obtained as by-products.

As a result of a critical working test made by experts, which completely confirmed our own conclusions, we are now building a small operative plant in Delaware, on what geologists tell us is perhaps the largest deposit of low grade iron ore in the world, stretching from near Washington, D. C., to New York. Of this more anon.

Wetherell Bros. Co., 251 Albany Street, Cambridge, Mass., dealer in steel products, has been appointed exclusive New England agent for Brown & Co., Inc., Pittsburgh, for handling United States, Soho, Wayne and other special irons.

The recently organized West Chapin Mining Co., Iron Mountain, Mich., which owns considerable ore property in the northern peninsula, is erecting a 100-ton blast furnace for the production of charcoal iron.

Changed Machine Tool Shops of Germany

Conditions at Ludwig Loewe Works as an Example—Shortage in Quantity and Quality of Expert Men—The Old Time Spirit Gone

BY CAPT. GODFREY L. CARDEN

Captain Carden, formerly of the U. S. Navy, went to Europe a few years before the war to make a study of the machine tool industry in several countries as special agent for the Department of Commerce. A number of letters from Captain Carden and extracts from his official reports appeared in THE IRON AGE *and indicated his close acquaintance with machine tool design and shop operation and his access to the most authoritative sources of information as to the competitive situation developing in Europe for American manufacturers of machine tools. To our issue of Dec. 7 he contributed an article dealing with the machinery industry in Poland as he found it two months ago when returning from Russia to the United States. It was followed (Dec. 21) by an article on conditions to-day in the famous Borsig Locomotive Works at Tegel. In this issue Captain Carden tells of the marked contrast between what he found at the great Ludwig Loewe Works recently and what he described in his pre-war report to the Department of Commerce.*

THE present state of the machine tool industry in Germany is reflected by conditions found at the Ludwig Loewe A. G. Works at Berlin. I visited these shops very recently and discussed the situation at length with both Directors Waldsmidth and Kuhn. The former I had known from pre-war days when I had occasion to report on the Loewe shops for the Department of Commerce.

At that time I advised that the Loewe works produced some of the best machine tools made in Germany, and the establishment was a fair sample of those German shops which are strong competitors abroad of American machine tool houses.

I well recall the snap and vim at these shops. The personnel numbered approximately 2000, and 54 hours work per week was the rule. The Berlin men were the best paid at that time in Germany, and with the mark at par the wages at Loewe's varied between 45 pfennigs per hour for unskilled labor to 1.25 marks and even more for skilled men. There are 100 pfennigs to the mark, and at par a mark is equal to 23.8 cents United States currency. As a matter of fact, Loewe's men were dissatisfied if they did not earn at the tools 85 pfennigs per hour. This they could readily do under the piece work policy which then existed.

To-day the conditions are materially different. There is ample work in sight, but the old time spirit is gone. Coming as I did out of Russia into Germany, from a country just emerging from a revolution, I had expected to find a very great contrast. As a matter of fact I was disappointed. Instead of the 9- to 10-hour work day the shops are now operating on an enforced union 8-hour day, and productivity, it is declared, has suffered. What overtime work is arranged for is secured always with great difficulty. The trouble, I learn, is not so much with the workmen, who are generally glad to work overtime, but with the unions.

Heavy War Losses of Machinists

During the war period the Loewe shops in common with other German machine tool plants had little opportunity to develop new ideas. The only thought during those years was mass production, and these shops were called upon to turn out much special equipment for the Government in addition to machine tools.

Dr. Waldsmith gave it as his opinion that no less than 60 per cent of the machine tool employees in Germany had been lost in the war. This number he included in the 2,000,000 lives lost to Germany. To-day, the German shops do not possess, it was declared, anything like the same proportion of skilled machinists as in pre-war days. The older hands were left behind by the army. Some of them are still carrying on, but it is necessary to develop young men before the German shops will be again on the level of excellence as in former years.

Notwithstanding that there was a general cessation in development during the war, there has been some improvement since. This has been in the nature of overhauling and refitting the shops. To a very great extent this has been accomplished throughout Germany. The machinery plants as a whole prepared to reengage in business as in former years, and put forward greater efforts than ever. Much of this determination has been thwarted by monetary conditions. It is a fact, however, that the German machine tool shops in general have been working in an intensive manner, and from April to August they have been able to supply the machinery works with all but special tools and have done something also in the export trade.

A Low Morale

Despite the intensive work demanded, the German shops are handicapped by the 8-hour limitations, and also by the physical qualities of the mass of the workmen. The high cost of food is reflected in undernourished workmen. The men readily become fatigued, and low physical state means also lessened alertness.

These views it was unnecessary for the directors at Loewe's to point out; the situation was obvious. The German machine tool shops of to-day are not the same shops of pre-war days. The morale is low.

In former years the Loewe workmen paid for house rents between 420 and 480 marks per annum. This secured two rooms and a kitchen. For one room and a kitchen the rents varied from 240 to 270 marks per annum. To-day the wages are just sufficient, I am told, to keep the workmen from real want. With the approach of winter much suffering would be bound to arise, and real distress was feared through the inability to purchase warm clothing.

From Mr. Froelich, who will be remembered as one of the distinguished members of the International Jury on Machine Tools at the St. Louis Exposition in 1904 and who is now directing important German machinery interests in Berlin, I learned much of the situation as it exists to-day. Mr. Froelich made no concealment that the work of the machinery industry in Germany, following the war, has been difficult in the extreme. The first and pressing necessity was to reach an approximation to productivity of normal times.

At the outset there began a gradual discharge of women, and of those men taken on during the war but unable to measure up to peace-time requirements. This sloughing off had to be conducted with care in order not to increase too suddenly the ranks of the unemployed. Coincident with this reduction, a general effort was put forth to get rid of all forms of war organizations charged during the war with the distribution of iron, steel, oil and other items, and also to free the industry from the supervision exercised over exported goods. This supervision had originally as its purpose the preventing of a shortage in important commodities, and to serve as a check on goods being sold too cheaply abroad. The machinery industry was for a new fixation of prices, due to the continued falling of the mark, and it was felt that the industry could meet the situation if left to itself. As it was, contracts based on future deliveries were difficult to execute. The machinery industry did not succeed in doing away with supervision. A new supervision was organized in 1920 and still continues.

Coal Shortage Handicap

One of the greatest difficulties encountered by the machinery plants has been the securing of raw material, and because of the demands of the allies there was experienced a real shortage in coal for the German plants. The quality of the fuel furnished has been poor, and very often on account of the refusal of the railroads, the fuel has to be transported for long distance by private car service.

Mr. Froelich declares that Germany, which exported in normal times a great deal of pig iron, is not able now to supply deficiencies in her own stocks, and this nothwithstanding that requirements are now less than one-half what they were in normal times. The shortage in iron in certain districts has grown and more and more iron has to be imported from the neighboring countries, especially from France and Belgium—the regions receiving to-day the bulk of the German coal deliveries.

Almost immediately following the end of the revolution orders began to pour in from foreign countries for German machine tools and the German industry undertook to satisfy these demands. The foreign business was especially attractive since political conditions in Germany had threatened to hold up further expansion in domestic shop installations.

The Mark's Collapse and Machinery

Despite the dropping of the mark, the export trade by 1921 had reached a point equal to 66⅔ per cent of pre-war times. The recent heavy fall in the mark may result in increased foreign orders, but it is doubtful, it is said, if this can be more than temporary, as the domestic prices are rising as rapidly as the mark is falling.

The machinery industry endeavored to help the monetary situation in opposing the falling of the mark through supporting the mark in foreign countries, using as one means the acceptance of marks in payment abroad. The pressure of the Reparations Committee, it is declared, compelled the machinery industry eventually to refuse payment in marks from foreign customers. For a time also an effort was made by the German machinery industry to adhere to fixed prices, but here again the industry had to give way.

The reparations policy is naturally charged with all or most of the evils of to-day. With the ending of the revolutionary troubles it was hoped that there would be an improvement in the German economic life which was falling lower and lower, but so far, it is asserted, no improvement is noticeable; in fact German economic efficiency is rated for 1921 at 60 per cent below pre-war standard, and in 1922 at 50 per cent under. It is pointed out that both the quantity and quality of available machinists is low for the reason that during the war there was no opportunity to maintain and develop an apprentice system. Not only the machine tool works, and machinery making plants, but manufacturing plants of all descriptions since the war have felt the tremendous shortage both in quantity and quality of skilled men. It would seem, it is said, as if Germany has been called upon to break in the youths of the land and endeavor to build up a body of skilled workmen. This will take time.

Technical Training Suffers

In addition to the manufacturing plants, the technical schools, those great engineering institutions at Charlottenberg, Leipzig, Munich, Hanover and Dresden have felt the pinch. There has been a dearth of capable instructors, and the machinery industry has been able only in part to help these institutions. Bear in mind that the German economic policy depended largely on these institutions to keep it equal to meet the inventive and productive competition of the world. The above technical schools turned out yearly several thousand young men, most of them with a very thorough engineering foundation, and as fast as these young men graduated they were absorbed by the great iron and steel, machinery, shipbuilding and other manufacturing plants, and to a very considerable extent German pre-war economic prowess was due to these graduates.

To enable students to-day to continue their studies, many of whom were forced to quit by reason of the lowering of the mark, there has been a very general practice on the part of shops of taking these students in during vacation period as transport workmen and when capable, as assistants. Unless the technical schools can be maintained the Germans feel that there is little to hope for in the future.

American Machine Tools

It is very evident from what the writer has seen at this time that the serious opposition which confronted the American machine tool trade abroad, just before the war, does not exist in the same form now, if indeed it exists at all. Down to the period of 1914 American machine tools, speaking in general terms, led the world. The best grades of American machine tools were seldom equaled. But wherever we excelled the German products we did it through superior technical knowledge and if we planned to hold this supremacy it was plain that it had to be done through our technical institutions. The Germans realize this fact as fully as they did when in the full power of strength.

While there may be a very great need for machine tools in Europe, that need does not constitute a demand. The demand arises when there is means to pay. As before the war, the market for American machine tools favors the high-grade tools. Many an American machine tool has been sold in pre-war days in the face of German competition because of superiority and seldom have American machine tools been sold in Europe under German quotations.

The German industry will doubtless come back, but just now it is far below the plane where it stood in 1912. In that year it had probably reached its peak. In 1912 also, American machine tool plants were reaching out and endeavoring to gain access to the foreign markets, especially in Europe. Some of our well-known firms have long been established in Europe through their own representatives, and those houses quietly maintained themselves and secured substantial business by reason of superiority both in technical design and construction of the machines they offered. This will doubtless be the test always in the machine tool trade. It is, therefore, significant that Germany to-day, despite all she is going through, is not losing sight of technical education.

Basic Business Conditions Improving

Production in Important Commodities Highest Recorded Since March, 1920—Heavy Recovery in Iron and Steel Retarded by Labor Shortage

BY SIDNEY G. KOON*

CONTINUING to display the buoyancy noted earlier in the season, the production of basic commodities in the United States has now reached the highest level which we have seen since the early weeks of 1920. There have been three major set-backs this year, the first coming in April, with the beginning of the coal strike; the second in July, with the beginning of the railroad strike and the third in September when, with coal stocks largely depleted, industrial establishments found themselves forced in many instances to suspend or severely curtail their operations, due to the tightening pinch of the acute fuel shortage.

But in each of these several instances the month following the drop showed an output greater than the month preceding the drop. This means that the rebound was greater than the fall. All of this goes to show the inherent soundness in the situation, and is perhaps remarkable in that it has been attained in each case in spite of fuel shortage, transportation troubles and scarcity of labor.

In the diagram showing the business index of production 21 separate items have been averaged in ten groups, of which the first four groups represent the elementary human needs of food, shelter, clothing and heat. The groupings are as follows:

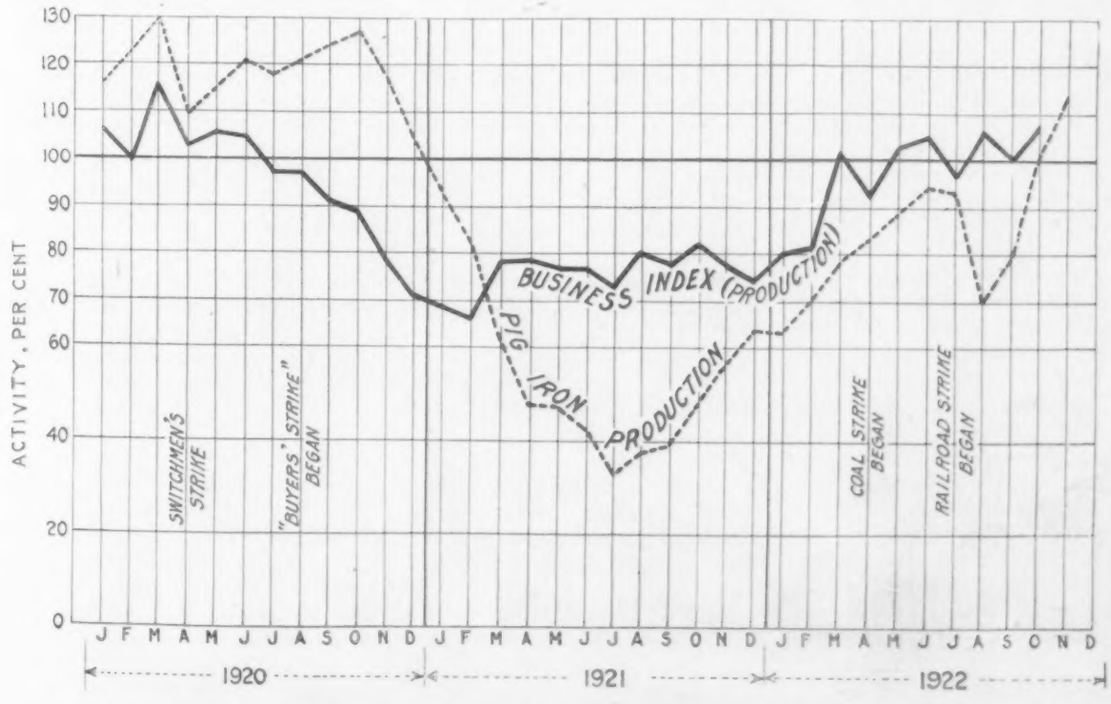
1—Food; beef, flour and sugar.
2—Building construction.
3—Textiles; cotton and wool.
4—Fuel; anthracite and bituminous coal and petroleum.
5—Vehicles; automobiles and trucks.
6—Leather; belting and sole leather.
7—Lumber; yellow pine, Douglas fir and Northern hardwoods.
8—Steel ingots.
9—Non-ferrous metals; copper, lead and zinc.
10—Newsprint paper.

All figures are expressed in their relation to the average monthly output of the year 1919. Dollars do not enter the curve, which is a story of physical quantities only. Each unit which goes into the makeup of the figure represents an element of production although, in some instances, as in textiles, this element is measured in terms of the consumption of the raw materials.

Both the present high elevation of the curve and its successive sharp recoveries from each set-back indicate that current production is in response to current consumption needs. We are no longer, except in spots and in a relatively small way, living on the accumulated surplus of previous fat years. The period between production of a commodity and its going into ultimate use has shortened markedly, and what is now being produced is largely for the satisfaction of immediate needs.

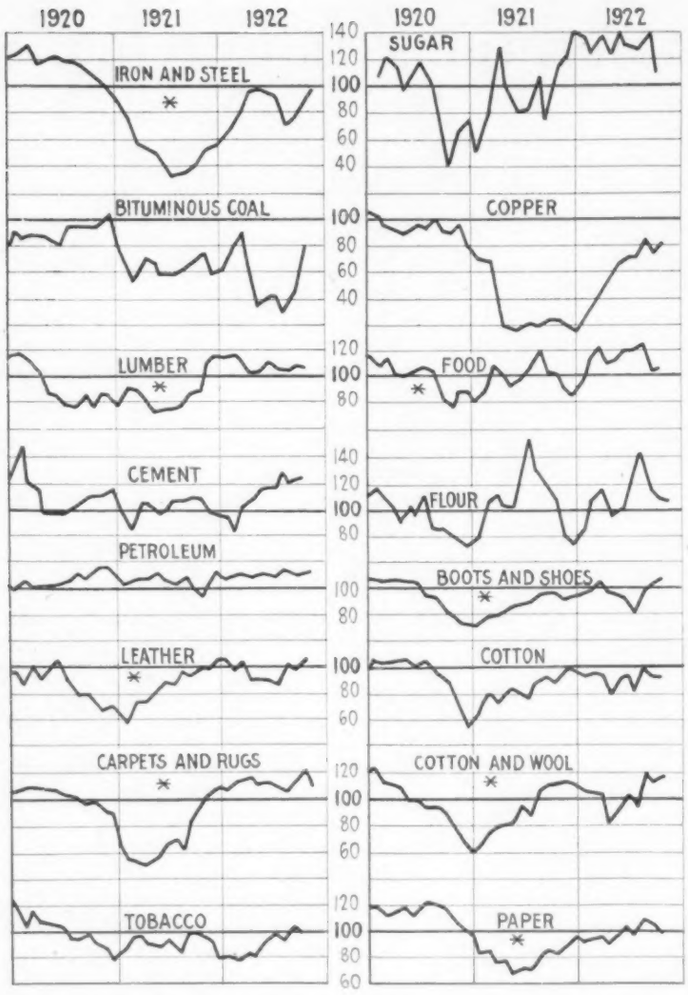
While the acuteness of the coal situation was almost wholly responsible for the drop in the production

*THE IRON AGE, New York.



In the Solid Curve Is the Story of Productive Activity in the United States from the Beginning of 1920. This is represented in tons, barrels, bales and square yards—not in dollars. The figures for each month are expressed as a percentage of the average month of 1919

Pig iron production, also in tons, appears in the dotted curve, which shows how much more heavily the iron and steel industry was hit by the slump in 1921 than was industry in general



Production Curves for Basic and Finished Commodities, Covering Three Years, and Showing Variations Above and Below the Normal. In most cases these data have been divested of the influences of seasonal trends and made to represent the percentage of customary activity at which the various industries are operating from month to month

curve in September, and the closing of the works of the Ford Motor Co. accounted for a large share in that drop, the increase in October is due primarily to a steady gain among the industries producing basic commodities. Of the ten groups covered in our study, all but textiles showed a gain during the month, and the loss in textiles was slight. The principal gain was registered by fuel, all three elements of which increased, but particularly by the jump of anthracite production from 68 per cent in September to 117 per cent in October. Only in a few of the separate items making up the groups was there a falling off, sugar, yellow pine and wool being the sufferers.

Unprecedented building construction, which has persisted to an unusual degree through the late fall and early winter months, has been accountable in no small way, not only for the upholding of the business curve directly, but also indirectly, through the stimulus thus afforded to other industries. Thus the building demand for structural steel, lumber, brick and cement, plumbing goods, pipe, etc., has helped those industries greatly, and through them has carried demand back to the more basic commodities such as pig iron and copper.

Another element of strength in the present situation and of good augury for the future lies in the continually increasing volume of retail purchasing. Department stores and chain stores report present business to exceed anything they have known in the past, and apparently the American public has reached the point where the effects of the so-called "buyers' strike" of 1920 have worn off. Depleted household stocks are being filled out and the beneficial results permeate all through industry.

On this page is a set of sixteen individual curves, each concerned with an individual commodity. Eight of these (indicated by *) were plotted from data of the Harvard Economic Service; the other eight were adapted from curves published by the Federal Reserve Board. All represent production in the same sense that our primary curve represents production, and in some instances the items are the same. Several things, however, enter the individual curves which are not covered in the general curve, these including cement, carpets and rugs, boots and shoes and tobacco.

It will be noted that those things which went most directly into ultimate consumption, such as food, cement, petroleum, boots and shoes, tobacco and paper, show far less divergence from the normal line than did those items of which the immediate application is more remote, such as iron and steel, copper, cotton, etc. Particularly will the wild fluctuations be noted of the metals, as represented by iron and steel and copper, which made the lowest records, during the disastrous year of 1921, of all the items shown. Both went well below 40 per cent of normal, while copper in several months showed less than 20 per cent.

Pig Iron Production

During this same period of three years —1920, 1921 and 1922—covered by both diagrams, the course of pig iron production has been traced for comparison. This appears in a dotted line on the diagram on the preceding page, which shows how very much more sensitive to business conditions pig iron production is than is the case with production in general. As noted above, it follows the trend of those commodities furthest removed from the immediate consuming public, in taking the highest flights in boom times and experiencing the lowest depths when business is stagnant.

Pig iron went from 130 as a maximum to 33 as a minimum. The larger is practically four times the smaller. The business index, however, showing production of 21 commodities, varied between a maximum of 115.7 and a minimum of 66. Here the larger is only 75 per cent greater than the smaller. This is clearly shown by the diagram, where the very great depression in pig iron, beginning with October, 1920, and reaching its lowest point nine months later, stands out strikingly.

Of the Future

Everything points to continued and increased activity in production, subject to such curtailment as continued shortage of fuel and labor and lack of adequate railroad facilities may impose. Both the coal and the railroad strikes interfered more seriously with basic production than with the production of the more complex finished materials in the later stages of development from the basic commodities. The recovery in the underlying items has therefore been less complete than with the others and they have been later in acquiring the impetus which some of the finished products have reached. Thus, the production of steel for auto-

(*Concluded on page* 95)

Prices of Iron and Steel and Other Products

Analysis of Basic Facts Shows Steel Lower Than Most Other Commodities—Changes in Past Year Indicated

ONE year ago THE IRON AGE published an article under the above title in which it was pointed out that finished steel was lower in comparison with the prices of other products than almost any other major item which could be selected. In other words, it was closer to the 1913 level than other principal commodities. This article was called forth by persistent attacks on steel by financial writers and others, who argued without knowledge of the facts and insistently demanded that steel be deflated.

Steel is higher today than it was a year ago, but so are most of the other products, and steel today, even with the increase which has taken place in 12 months, remains lower than clothing, fuel, lighting, building materials, house furnishings and the average of all commodities as compiled by the United States Bureau of Labor Statistics. Steel is also lower with relation to the 1913 base than either anthracite or bituminous coal. It is lower than petroleum, gasoline or coke. It is lower than yellow pine, shingles, cement, lime, brick or glass among the principal building material items. It is lower than raw cotton, raw silk, cotton sheeting, worsted suitings or shoes, and it is lower than potatoes, flour or milk.

Steel as a Manufactured Product

With regard to some of these products, the comparison is hardly fair to steel, because steel is a manufactured product and some of the others are raw materials. In other words, steel has had done upon it a large amount of labor, at high price, and has had expended upon it a large amount of fuel, also at high price. Furthermore, for every ton of steel produced, more than five tons of materials have to be moved by railroad at a price which everyone will concede is high and unduly high.

Among the major commodities, the only items which are lower than steel are the chemicals and drugs, the non-ferrous metals and some of the small items classed by the Labor Bureau as miscellaneous, together with farm products and foods. Among the individual items in the accompanying table, aside from the general items just mentioned, only two are lower than steel, these being mess pork and smoked hams.

In the diagrams shown at the bottom of the page the horizontal line marked 100 represents the prices of 1913. The total height of the column represents the peak prices attained during 1920, as compared with the 1913 prices. The portion of the column up to the top of the dotted section represents the prices prevailing one year ago. Above this latter will be found a sectioned portion of the column representing the advance in prices during the past year, and showing at the top of this section the present prices relative to 1913. In a few cases, such as building materials, chemicals, house furnishings, miscellaneous, petroleum, brick, lime, glass, sheeting, shoes and hams, the present price is lower than it was a year ago. In these cases the sectioned portion of the column runs down below the top of the dotted portion, showing the net drop in prices through the 12 months. Foods and milk are at the same level as last year and hence show no sectioned portion.

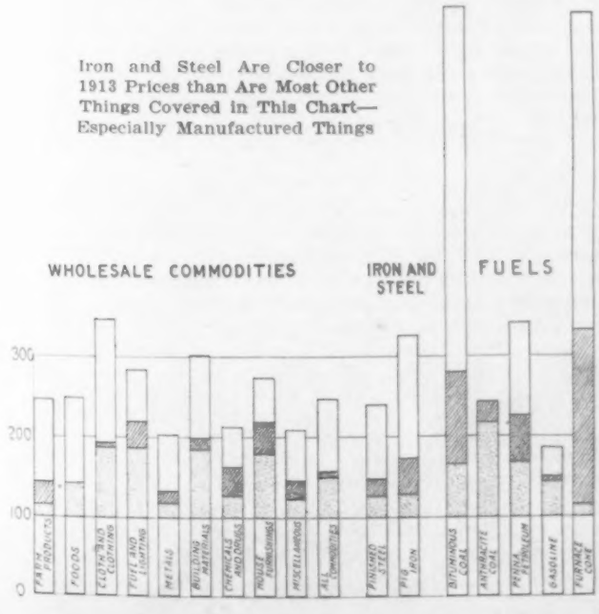
Course of Prices Over Three Years

The other diagram traces the course of prices, across 1920, 1921 and 1922, of five separate commodities or groups of commodities. All are based on the average of prices in 1913 at 100. Steel beams and THE IRON AGE composite price for finished steel are taken from this journal's own quotations week by week. The other three lines are from the United States Bureau of Labor Statistics, one showing the average of all commodities, while the other two show respectively building materials and cloth and clothing.

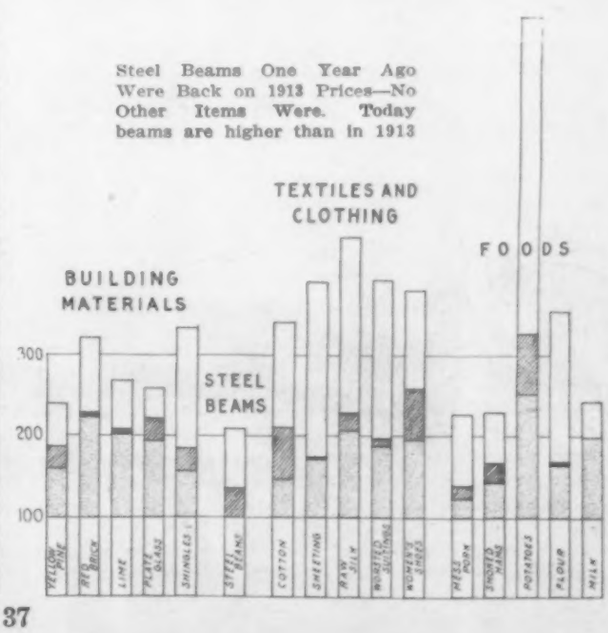
It will be noted that steel beams are lower than all the others every month through the three years, with the exception of May, 1921, when the price rose momentarily slightly above the "all commodity" price. Finished steel was lower than any of the others, except during the period from August, 1920, to August, 1921, when it was above the "all commodity" curve and during one month was above the building materials curve. Cloth and clothing has consistently held the highest position of all throughout the entire period, while building materials, except for the one month just mentioned, have consistently held the second highest position.

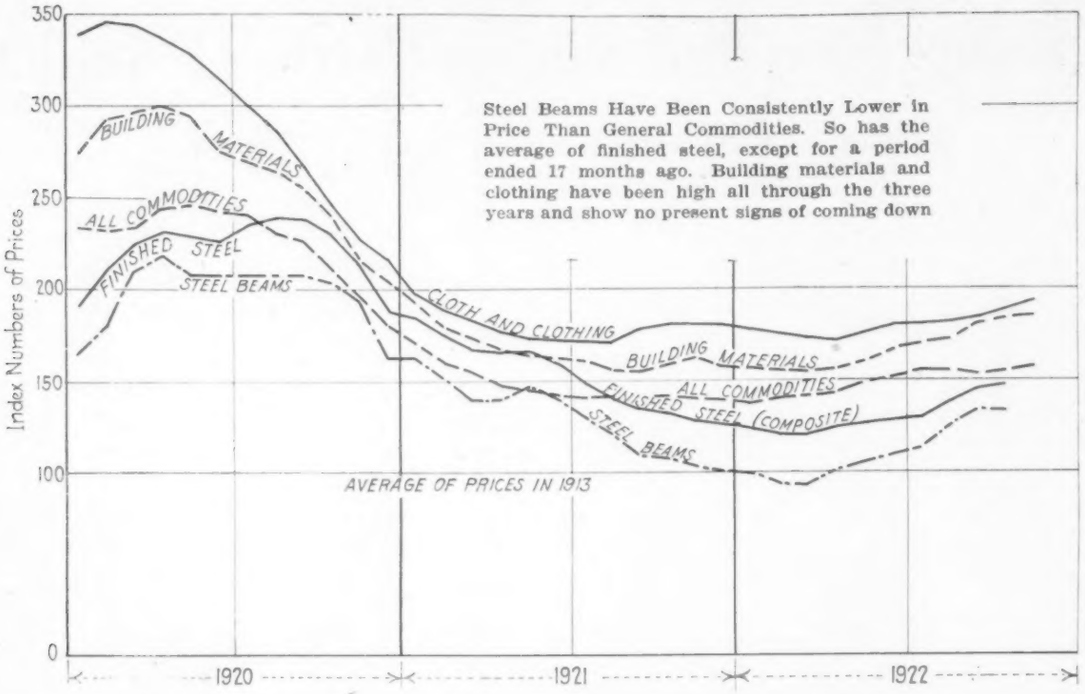
In the table will be found the basic figures upon which the index has been computed, forming the back-

Iron and Steel Are Closer to 1913 Prices than Are Most Other Things Covered in This Chart—Especially Manufactured Things



Steel Beams One Year Ago Were Back on 1913 Prices—No Other Items Were. Today beams are higher than in 1913





ground of the diagrams. The figures have been gathered from various authoritative sources, some of which are governmental and some are not. Figures given are the latest data available before going to press.

Item	Prices Quoted: Aver. 1913	Peak 1920	One Year Ago	Present Figure	Index Number (1913=100): Peak 1920	Present Figure
Farm products	....	....	....	....	247	143
Food, etc	....	....	....	....	248	143
Cloth and clothing	....	....	....	....	346	192
Fuel and lighting	....	....	....	....	281	218
Metals and metal products	....	....	....	....	203	133
Building materials	....	....	....	....	300	185
Chem. and drugs	....	....	....	....	213	127
House furnishings	....	....	....	....	275	179
Miscellaneous	....	....	....	....	208	122
All commodities	....	....	....	....	247	156
FINISHED STEEL	1.663c.	3.974c.	2.062c.	2.439c.	239	147
PIG IRON (Composite)	$14.70	$47.84	$18.68	$25.79	325	175
STEEL BEAMS	1.50c.	3.10c.	1.50c.	2.00c.	207	133
Fuels						
Bituminous coal	$1.34	$10.00	$2.20	$3.75	746	280
Anthracite coal	3.82	8.00	8.25	9.25	209	242
Furnace coke	2.41	17.75	2.75	8.00	735	332
Penna. petroleum	1.79	6.10	4.00	3.00	341	168
Gasoline	16.8c.	31c.	24c.	25c.	185	149
Building Materials						
Yellow pine	$28.50	$67.50	$45.00	$53.00	237	186
Red brick	6.20	19.85	14.10	13.74	320	222
Lime	4.43	11.85	9.16	8.89	268	201
Shingles, red cedar	1.97	6.57	3.06	3.63	334	184
Plate glass	31.8c.	82c.	70c.	61c.	258	192
Textiles and Clothing						
Raw cotton	12.84c.	43.75c.	18.8c.	26.86c.	341	209
Sheeting	7.3	28.5	12.6	12.0	390	164
Raw silk	$3.65	$16.25	$7.50	$8.35	445	229
Worsted suitings	1.38	5.42	2.57	2.70	392	196
Women's shoes	2.17	8.25	5.60	4.23	379	195
Foods						
Mess pork	$20.93	$47.00	$25.00	$29.00	225	139
Smoked hams	16.60	37.70	27.60	23.50	227	142
Flour	4.61	16.25	7.50	7.65	353	166
Potatoes	61.4c.	4.43	1.53	2.00	721	326
Milk	3.5c.	8.5c.	6.9c.	6.9c.	243	197

Lead and Zinc in 1922

The mine and refinery output of lead in the United States in 1922 each made a good gain, and the mine and smelter output of zinc each increased about 70 per cent, according to a statement by C. E. Siebenthal and A. Stoll, of the U. S. Geological Survey, compiled from reports and estimates by producers and others. Data for the Western States are taken from the advance statements issued by the Geological Survey's western offices. Statistics of imports and exports are taken from the records of the Bureau of Foreign and Domestic Commerce; the imports include only those for the period before the new tariff went into effect (Jan. 1 to Sept. 21), but the exports include the actual exports for 10 months, plus an estimate for November and December.

The output of soft lead by mines of the Mississippi Valley (including the small output of the Eastern States) was about 256,000 net tons, and that of argentiferous lead by mines of the Western States was about 208,000 tons, a total of 464,000 tons. The corresponding figures for 1921 were 237,209 tons from the Mississippi Valley and 172,491 tons from the Western States, a total of 409,700 tons.

The recoverable zinc content of ore mined in 1922 was about 442,000 tons, as compared with 256,746 tons in 1921. The output of the Eastern States was about 90,000 tons (80 per cent from New Jersey), that of the Central States about 272,000 tons, and that of the Western States about 80,000 tons, as compared with 67,711, 175,262, and 13,773 tons, respectively, in 1921.

The output of primary domestic desilverized lead in 1922 was about 181,000 short tons, of soft lead about 204,000 tons, and of desilverized soft lead about 76,000 tons, making a total output from domestic ores of about 461,000 tons of refined lead, as compared with 398,222 tons in 1921, which was made up of 187,962 tons of desilverized lead, 157,513 tons of soft lead, and 52,747 tons of desilverized soft lead. The output of lead smelted and refined from foreign ore and bullion was about 70,000 tons, as compared with 50,367 tons in 1921. The total lead smelted or refined in the United States was thus about 531,000 tons, as compared with 448,589 tons in 1921. The output of antimonial lead is reported to be about 6,500 tons, as against 10,064 tons in 1921.

The exports of lead of foreign origin were about 35,000 tons and of lead of domestic origin about 5,500 tons, as compared with 34,369 tons and 1,624 tons, respectively, in 1921. The imports of refined pig lead of which statistics are available for the period under the old tariff only (Jan. 1 to Sept. 21, inclusive) were 2,500 tons, as compared with 31,301 tons in 1921 and 35,719 tons in 1920. From a total supply of about 533,000 tons of refined lead (exclusive of stocks) there was withdrawn for export about 38,000 tons, leaving 495,000 tons available for consumption in the United States, as against 444,872 tons in 1921 and 538,020 tons in 1920.

R. E. Olds, president of the Reo Motor Car Co., Lansing, Mich., has sold the Oldsmar tractor plant, Oldsmar, Fla., to the Cornwell Real Estate Co., St. Louis.

Changes in "Spread" Between Products

Old $5 Difference Between Pig Iron and Billets Has Now Become $10—Same Between Billets and Bars—Study of Sheets and Tin Plate

BY SIDNEY G. KOON

IT was once regarded as substantially axiomatic in the steel industry that a $5 spread would cover costs between pig iron and billets and a similar $5 spread would cover costs between billets and steel bars. Recent eras of high prices have upset this interesting theory, and there have been instances within the past year when the spread between billets and bars has been far below the $5 standard.

During the good business of 1910 and the first half of 1911 the spread between pig iron, as represented by THE IRON AGE composite figure, and billets as quoted at Pittsburgh, hovered around the $9 mark. The figure did not go below $6.66 on the dip of the curve through the poorer business months running into 1912. At the end of 1912 the curve for the first time crossed the $10 line and remained well above it until the fall of 1913, reaching a high point at $12.76 in April. During the whole of 1914 the figure stayed between $6 and $8.17, this narrow range showing about the same average figure as was experienced between June, 1911, and June, 1912.

As might have been anticipated, the corresponding figures through the year 1919 were for the most part above the $10 mark, the average for the year being $11.54. During the booming times of 1920 the figure shot upward, reaching a maximum of $17.83 in March. The average for the first eight months of that year was more than $15. From the middle of 1920 up to the present, the figure has been very erratic, dropping below the $10 mark at the end of 1920 and going above $15 again in the summer of 1921, only to drop below $10 three months later and holding closely to that line ever since. The spread in November, for instance, was $9.94, and the average for 1922 was about that same figure.

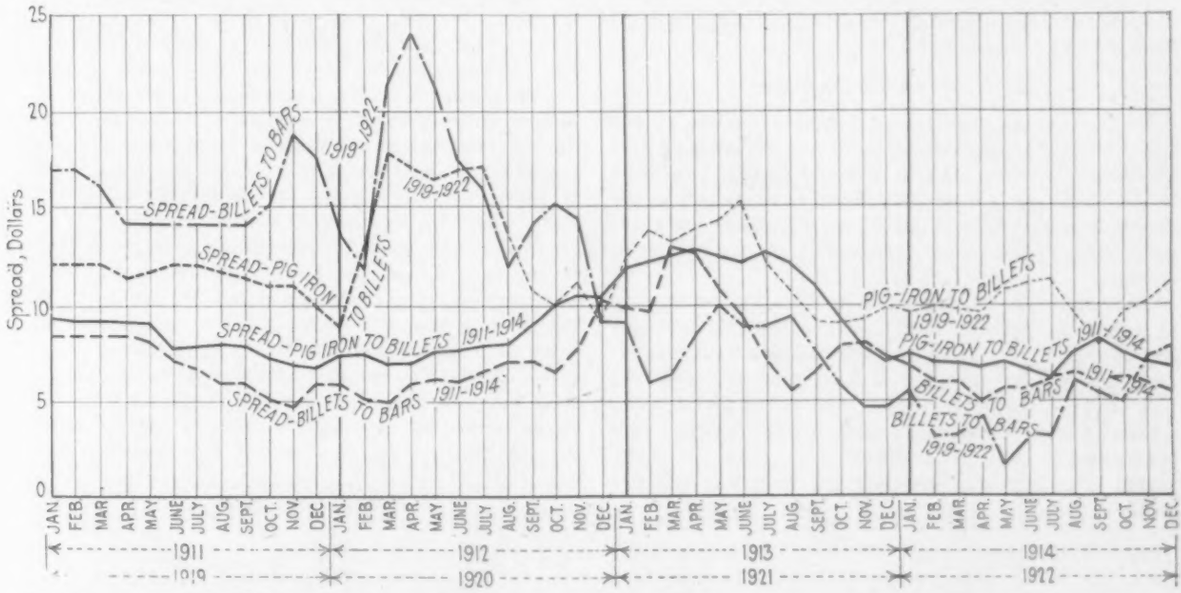
From all the above it follows that the old $5 spread, long considered satisfactory, for taking care of manufacturing and selling costs between pig iron and billets, ceased to be a satisfactory index more than ten years ago. The average for the four pre-war years covered in the chart was $8.68, while the average for the four post-war years was $11.89. It may perhaps be hardly fair to include in such an average the swollen figures of 1920. If we omit these, we find that the average of 1919, 1921 and 1922 works out at $11.11. Apparently, therefore, a new base line has been established which might tentatively be placed at $10, for all purposes of rough and ready calculations. This $10 may therefore reasonably be expected to cover substantially the conversion costs from pig iron into steel ingots and thence into the billets of commercial size.

From Billet to Bar

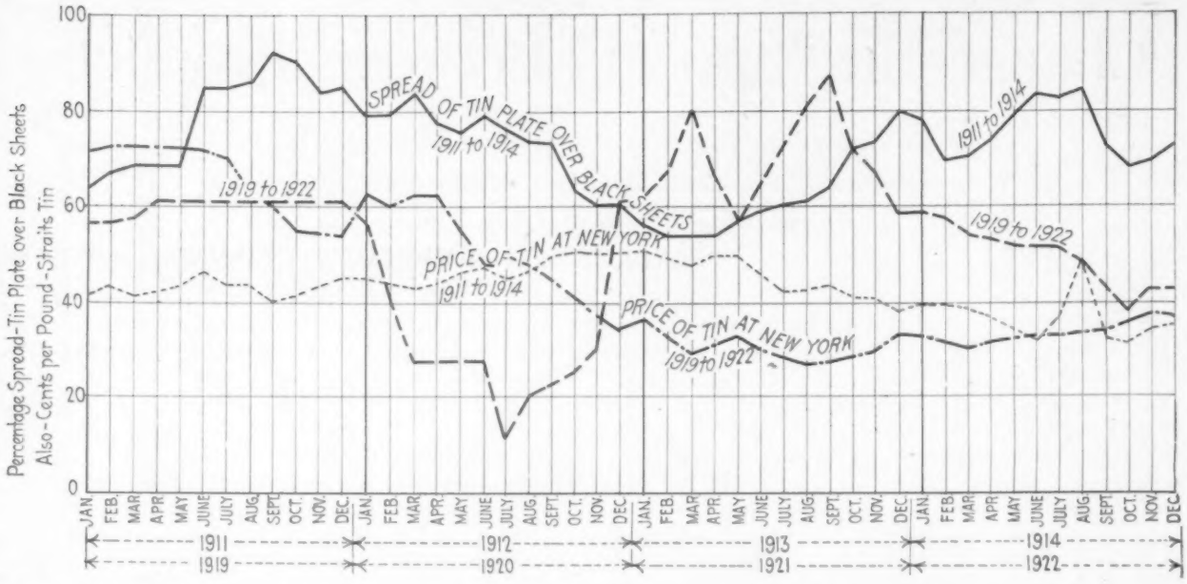
Similar figures showing the spread between billets and bars indicate that the same higher level has now been reached, while the average figures for spread in the four post-war years ($10.61) compare with the $11.89 spread from pig iron to billets. And the course of the curve has been just about as erratic as in the other case. In the four pre-war years the spread between billets and bars reached a maximum of $12.94 in March, 1913. The minimum of $4.69 in November, 1911, was closely approached by the $4.89 the following March, the $4.96 in April, 1914, and the $4.97 in December of that year.

In the post-war years this spread has fluctuated even more violently than before, and far more violently than in the case of the pig iron to billet spread over the same period. In fact, in April, 1920, the spread between billets and bars reached a maximum of $24, while in May, 1922, it got down to $1.59. This ratio of more than 15 to 1 may be compared with a ratio of less than 3 to 1 in the pre-war years for the same products, and a ratio of less than 2½ to 1 between maximum and minimum spread from pig iron to billets in the four most recent years.

Evidently $10, again, may be accepted as a tentative



Pre-War and Post-War Spreads Between Pig Iron and Billets and Between Billets and Steel Bars, Each Traced Across a Period of Four Years



Relation of Percentage Spread Between Black Sheets and Tin Plate to Simultaneous Price of Straits Tin. Each is shown over a period of four years pre-war and four years post-war

standard for the spread between billets and merchant bars, in place of the $5 formerly in vogue. Thus the $10 figure in the case of each of the two separate spreads takes the place of the $5 figure long regarded as a satisfactory guide.

Black Sheets to Tin Plate

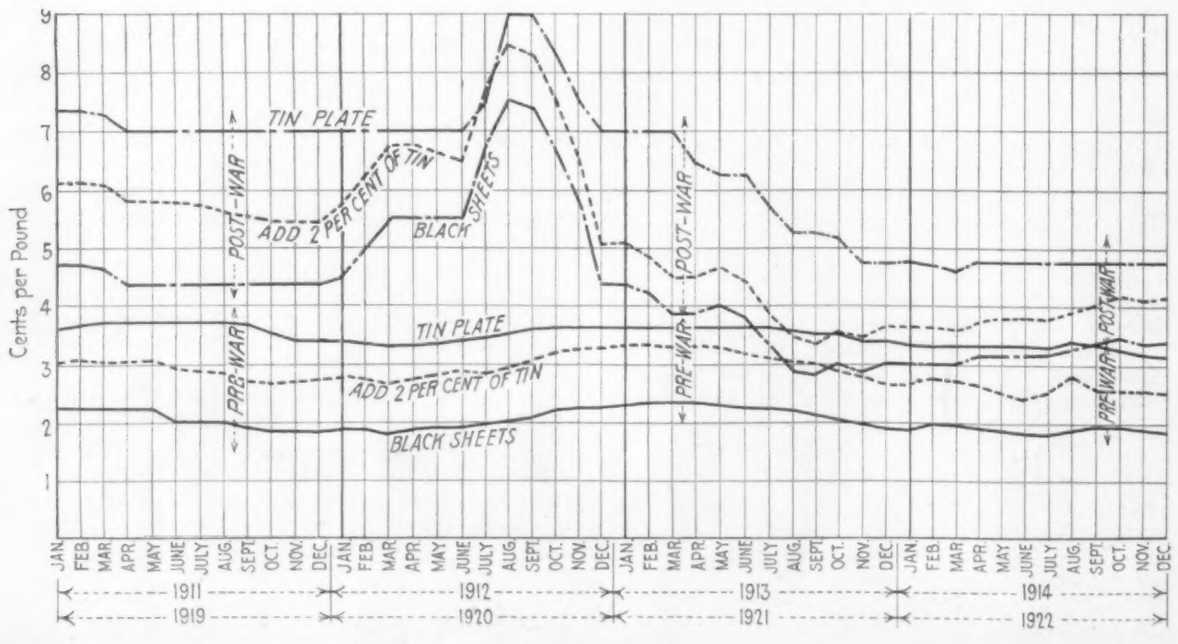
It has been argued in many quarters that the spread between black sheets and tin plate was governed largely by the price of tin. While it would be idle to combat this as a theory, a study of the curve of spread as observed from month to month shows that there are other influences at work, besides the New York price of Asiatic tin.

During the period from 1911 to 1914, the percentage by which the price of tin plate exceeded that of black sheets varied from 53 to 92. The changes with few exceptions were not abrupt. In fact, the curve shows a sort of cyclic character, with a peak in the fall of 1911, a broad hollow centering in early spring of 1913 and a peak again in 1914. The average throughout the entire period of four years, preceding the war, was 71.2 per cent.

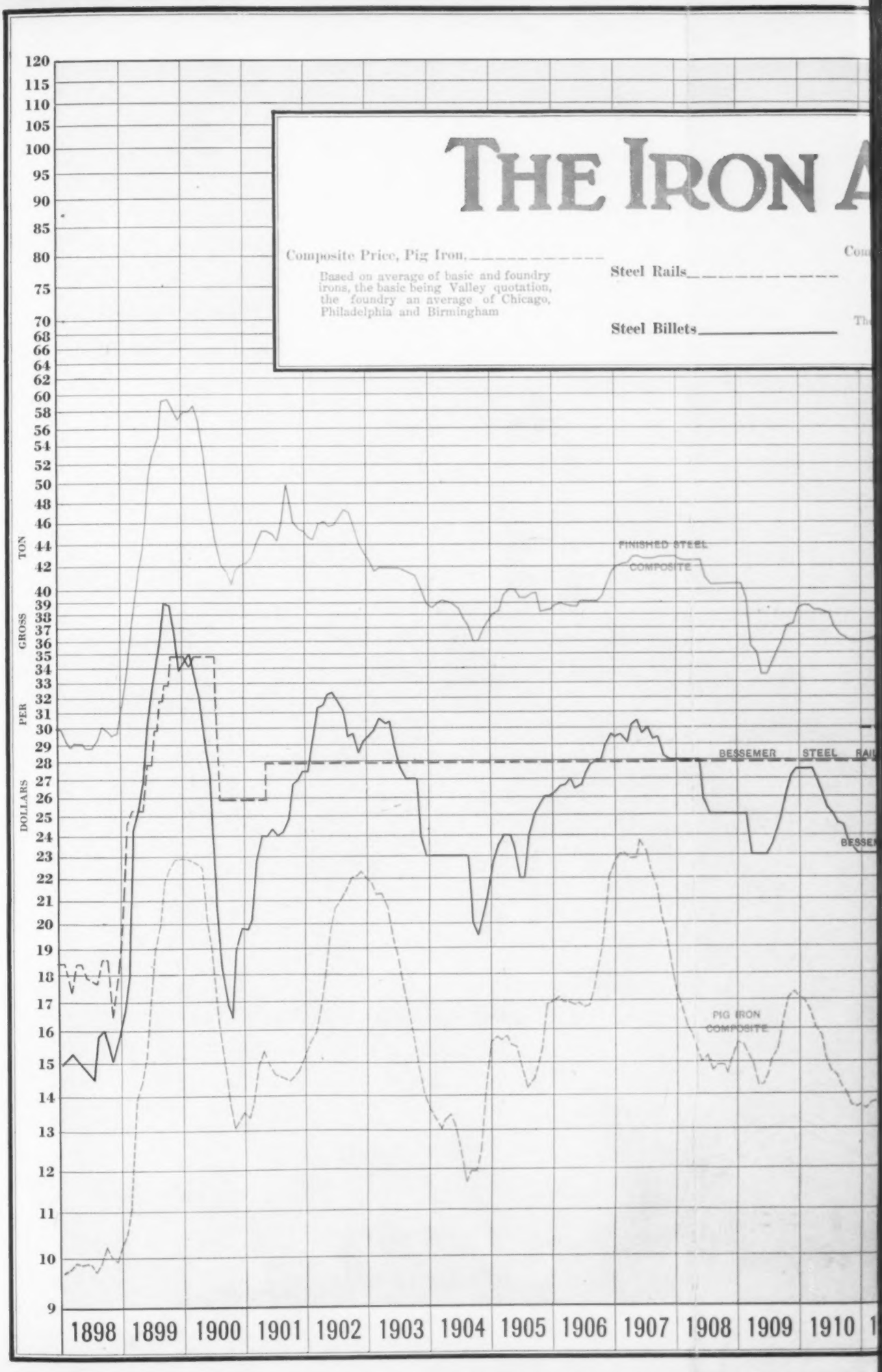
Now it happens that the price of tin through 1911 and the first eight months of 1912 was fairly stable, the lowest month (September) showing 39.69c. average, while the highest, reached in June, 1912, was 47.44c. The average price over this period was thus fairly uniform at about the 43c. mark, but the percentage spread jumped from 63.6 at the beginning of 1911 and 68.2 in May to more than 92 in September of the same year, during which month the price of tin was actually at the lowest figure for the first 30 months of the 4-year period. In other words, while the spread was at a maximum, the price of tin was near the minimum.

In the same way, the big dip in the curve of spread in the fall, winter and spring of 1912 and 1913 was accompanied by the highest prices for tin during the entire four years, if we except the momentary panic price of August, 1914, due to the beginning of the big war. During the last half of 1912 and the first half of 1913 the price of tin averaged more than 48c., as compared with 42½c. average for the four years, and yet it was during this very period that the percentage

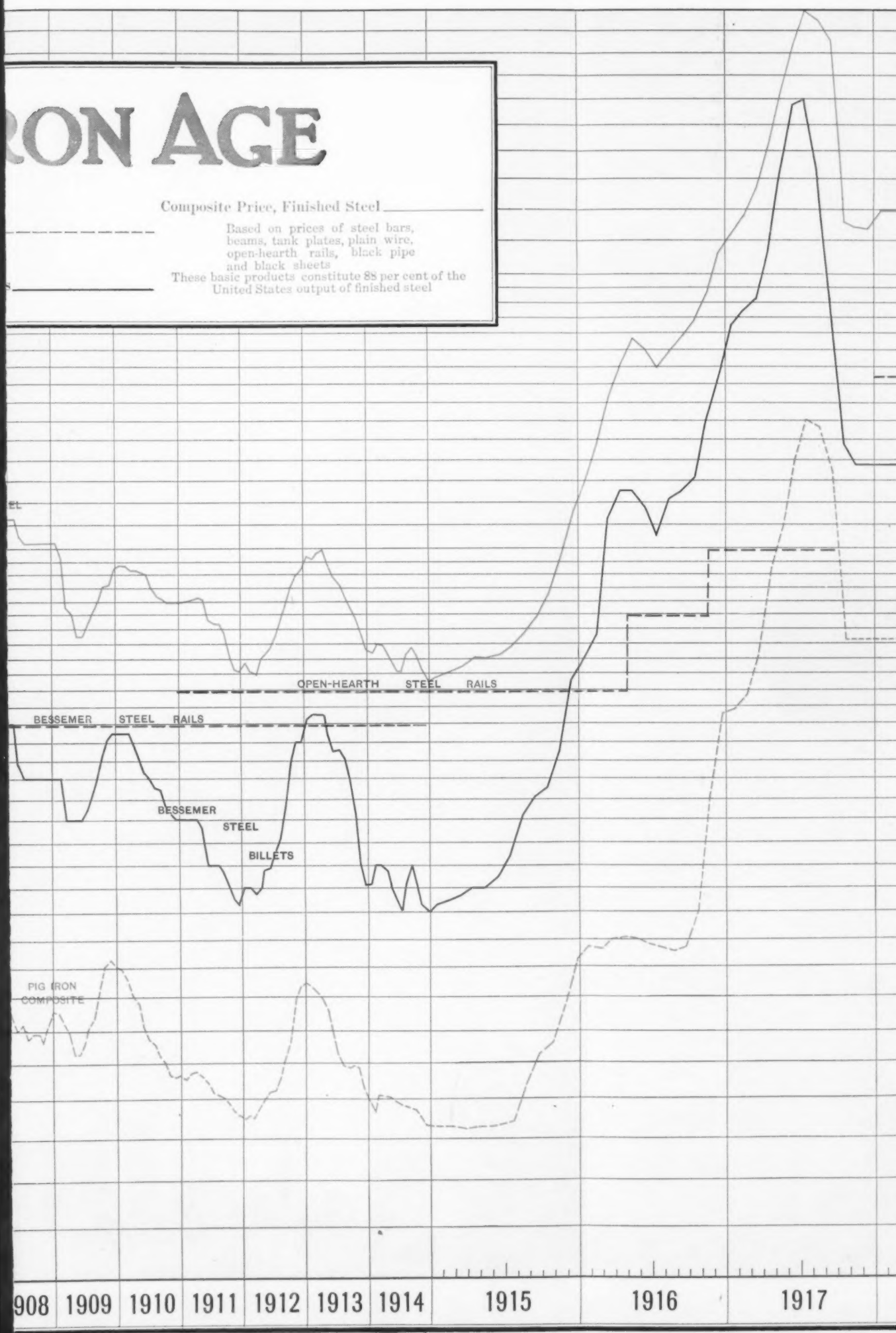
(*Concluded on page 43*)



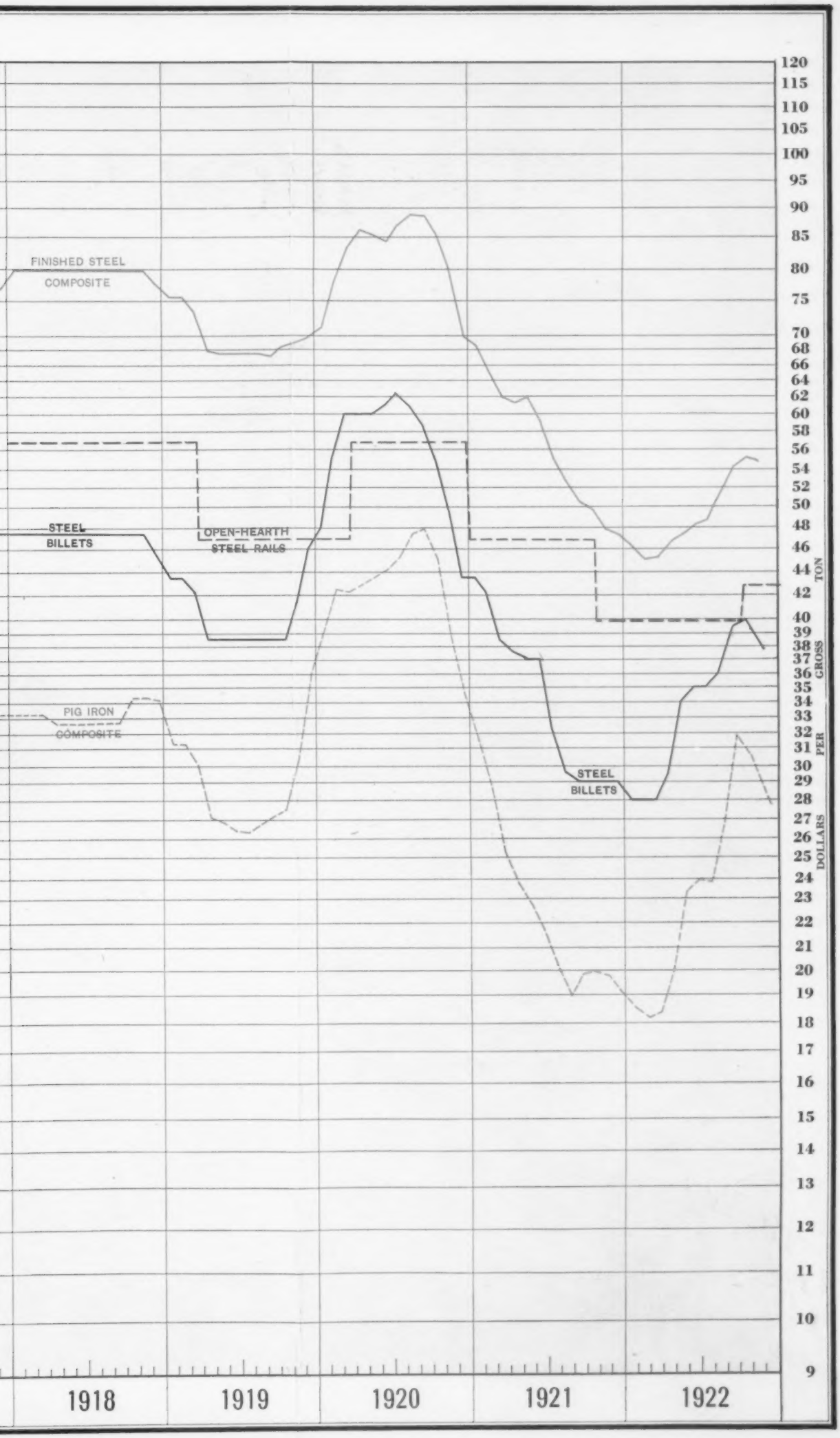
Study of the Relation Between the Price of Tin Plate and the Price of Black Sheets Augmented by 2 Per Cent of the Price of Tin. Four years pre-war are compared with four years post-war



Quarter Century of Fluctuations



f Fluctuations in Prices of Pig Iron and Semi-finished and Finished



ed Steel and of Steel Rails

(*Concluded from page* 40)

spread between sheets and tin plate was at its lowest.

When we come to consider the four-year period subsequent to the war, beginning with January, 1919, we find a most erratic condition. During the whole of 1919 the spread was very close to 60 per cent. Such a sharp drop developed through 1920, however, that by July it had declined to 11.1 per cent, only to jump back in December to more than 60 per cent. Since that time the average has been close to 60 per cent, going above 80 per cent twice, but getting down in the latter part of 1922 close to 40 per cent. The lowest figure in the last two years was that for last October, at 36.9 per cent.

In this case the percentage of spread followed more closely the curve of tin prices, for the declining prices of tin through the greater part of 1920 was accompanied by the lowest percentage spread between black sheets and tin plate. At the same time, however, the low tin prices of the second half of 1921, which were the lowest for any half year in the four years, and indeed the lowest for any half year in the entire eight years covered by this survey, were accompanied by a high figure for the spread, reaching a maximum of 86.8 per cent.

It appears evident, therefore, on the face of the returns, that the price of tin cannot be relied upon as a definite index to the price of tin plate, or as to the spread between black sheets and tin plate.

Sheets Plus 2 Per Cent of Tin

Another method of analysis, in which the quantities are expressed in cents per pound rather than in percentages, as shown in another chart, which consists for each of the two periods of three lines. The lowest line is the price of black sheets. The intermediate line is the price of black sheets plus 2 per cent of the price of tin. The upper line is the price of tin plate. Obviously, as current practice adds 2 per cent by weight of tin to the black sheets in the production of tin plate, the intermediate line represents only one element of extra materials cost in making the tin plate. Hence the space between the intermediate line and the upper line, representing as it does the margin between materials cost and price, indicates what the tin plate maker has to work on in providing his other materials, labor, power and selling expenses, together with all of his interest, overhead and profits.

On this basis, examination of the chart shows that there is a great difference from time to time between the spread figures thus developed. During the summer of 1911 the spread was fully 50 per cent higher than it was at the beginning of that year or during the first half of 1912. In the winter of 1912 to 1913 this spread was only about one-third as great as it was in the summer of 1911. In the latter part of 1913 and through 1914, however, it widened out again and approached the condition of mid-1911.

During the post-war years this variation was violent. In fact, in July, 1920, the sum of the two material figures actually exceeded the price of tin plate, and through the greater part of that year the margin was very small. Thus in March, 1920, the difference between the material prices and the tin plate price was less than one-sixth as great as it had been the preceding December. Early in 1921 again the spread was very great, the maximum for the entire period being reached in March, at which time it was about 2½c. From that time to the present there has been a gradually narrowing band representing the spread between materials and selling prices, although there have been the usual minor up and down fluctuations throughout this period.

An Active Year in Cast Iron Pipe

CAST-IRON pipe makers had a noteworthy year in 1922. Prices rose and the total tonnage shipped was heavy, this in the face of rail embargoes, the coal strike, and a shortage of skilled labor. Buying has been heavy from both municipalities and large private purchasers. The City of New York was steadily in the market.

January and February saw prices fairly stable on pressure pipe, a few municipal tenders and a fair degree of private buying. But in January, Chicago reported shading of the current quotation on water pipe by as much as $2 per ton. By the end of January, the Chicago market had declined again on water pipe, but by this time more than 50 miles of water mains were reported under consideration in that district.

Activity in the East was also delayed until February. As the year progressed, activity increased in a gradually rising wave, accompanied by a strong upward movement of prices. During January, the Pacific Coast consumers, who were active in both water and sanitary pipe throughout the year, received shipments from Mobile by water aggregating 7000 to 8000 tons, and this pace was rather generally maintained for the rest of the year.

In February, although business was beginning to assume considerable proportions, Birmingham makers were reported in many instances to be guaranteeing against price decline, evidently in view of the condition of the pig iron market at that time, but by the middle of February numerous tenders were appearing and the Birmingham makers reported the first strong inquiry. A turn for the better was apparent. By the end of February the water pipe plants of the National Cast Iron Pipe Co. and the American Cast Iron Pipe Co., were reported at not far from capacity operation, and the three plants of the United States Cast Iron Pipe & Foundry Co. gradually increasing production. Price cutting had practically ceased. In May the Imperial Pipe Co.'s Bessemer plant resumed production and manufacture of pressure pipe was begun again at the Standard Foundry Co.'s Anniston plant and the Central Foundry Co. resumed at Holt.

By the middle of March, a large maker in the New York district was operating at 85 per cent of capacity, Chicago began increasing prices and Birmingham jobbers, although still reluctant to stock up, were stated to be showing a much better attitude. From March until the end of the year, municipal tenders did not bring out very much lower than current prices. Price stiffening and a gradual rise in prices in Birmingham, Chicago and New York was the rule in the following months as demand grew heavier.

While the greatest activity was noted in the Eastern district during the early spring, as the year progressed both the South and West began to make great strides in buying. Deliveries became extended in all districts by June, particularly on the smaller sizes of water pipe. Birmingham makers began to offer 30 to 75 days delivery and a maker in the New York district was about two months behind. This condition was maintained throughout the year, in some instances delivery extending to from three to four months and bonuses being paid for early shipment. By the middle of June, the leading Birmingham sanitary interest was reported out of the market.

Dullness set in by September and continued until December. Unfilled tonnage of makers of pressure pipe and the unusual activity of private purchasers in some districts kept operation at full capacity until the end of the year, with tonnage to carry most makers over well into 1923. Prices of cast iron pipe, monthly, from 1902 through 1922, appear on page 73.

The year's production of gas and water pipe has been estimated at 850,000 net tons.

Pig Iron and Steel Output of the World

Still Below Pre-War Record—Two Pre-War and Four Post-War Years Compared—Exports of the Leading Countries

BY EDWIN F. CONE

FOUR years of iron and steel production have passed since the close of the world war. As in economic and financial matters, so in iron and steel production and exports, the effect of that struggle has been the dislocation of all normal relations and the reversal of trends which obtained before the war. At the close of 1918 there were predictions of a tremendous peace demand for iron and steel. The world was pointed to as far behind in the usual consumption of steel products. An analysis of the world production and trade in steel and iron shows what a dream this prophecy was. The glaring fact stands out from these data that in none of the four years just passed has the production or export of the five leading countries equaled the records made in 1912 or 1913.

Output and Exports of the Five Leading Countries

THE world's output of pig iron and steel is made largely by five countries: United States, Great Britain, Germany, France and Belgium. The outputs of Canada and Luxemburg are by no means small, but before the war the latter country was included in Germany. Canada in 1913 was not a large factor. The data on which the following analysis is based are taken largely from those published by the National Federation of (British) Iron and Steel Manufacturers. The record of each country is briefly discussed first and then that of the five countries as a whole. Under "steel" is included castings. Scrap is not included in the exports.

The American Industry

A detailed discussion of the course of the American iron and steel industry in 1922 is found elsewhere in this issue. So far as the past year is concerned only in the last two months had the pig iron and steel output approached the rate attained in 1920. The interesting feature for 1922, however, has been the wide spread between the pig iron and the steel production, a spread which has not been equaled in any of the years under review. The pig iron output, estimated at 26,800,000 gross tons, is the lowest with respect to the steel output of any year on record, with the exception of the year of depression in 1921. Undoubtedly the explanation for this wide spread, while in part attributable to the coal and railroad strikes, has been more largely caused by the unprecedented use of scrap in open-hearth furnaces.

The country's steel output, estimated at 34,350,000 tons, including castings, while considerably less than that of 1920, is not far from that of 1919. The 1922 record has the distinction of being the only one for any country in which the steel output in 1922 was larger than in either of the two pre-war years, 1912 and 1913.

As revealed by the table, the country's record in exports has been one of the lowest attained in recent years. With the sales to foreign nations for the year estimated at 1,970,000 tons, the volume is less than 70 per cent of that before the war and less than one-half of that in 1919 or 1920.

American Iron and Steel Output and Exports During Peace Years in Gross Tons

United States	Pig Iron	Steel	Exports
1912.....	29,727,000	31,251,000	2,418,000
1913.....	30,966,000	31,300,000	2,892,000
1919.....	31,015,000	34,671,600	4,399,000
1920.....	36,926,000	42,133,000	4,706,400
1921.....	16,688,000	19,783,000	2,172,000
1922.....	26,800,000*	34,350,000*	1,970,000†

*December estimated. †November and December estimated.

The British Industry

The contrast in the course of the British steel industry with that of the American in 1922 is interesting from several points of view. Throughout the year the spread between the pig iron and steel output has been without precedent. At the close of the year, however, a gradual recovery from a depression which had existed since early in 1921 asserted itself to such an extent that the steel output had attained a monthly average almost equal to that of 1913. In pig iron, however, while the output at the close of the year was over twice that of the monthly average in 1921, it was only a little over half the monthly average in 1913. The table of outputs for the years under review shows the contrasts in pig iron and steel production and in exports. Here again the recovery in either pig iron or steel has not approached the records made in 1919 and 1920 with the output still far below the pre-war records. The effect of the war and the 1921 depression are clearly revealed.

Probably the most striking feature of the course of the British steel industry in 1922 has been the recovery in its export trade. No other country except possibly France has been able to make so good a showing. With exports last year estimated at 3,400,400 gross tons the foreign trade in iron and steel, while not equal to the pre-war, exceeds 1919, 1920 and 1921. They were also higher in proportion to the steel output than in any of the other years. Undoubtedly Great Britain is slowly regaining its position as an exporter of iron and steel and already far outstrips the progress made by the United States, not only last year, but in any pre-war year.

British Iron and Steel Output and Exports During Peace Years in Gross Tons

Great Britain	Pig Iron	Steel	Exports
1912.....	8,748,000	6,792,000	4,807,200
1913.....	10,260,000	7,688,000	4,969,200
1919.....	7,404,000	7,896,000	2,223,200
1920.....	8,034,000	9,067,200	3,250,800
1921.....	2,611,200	3,625,200	1,706,400
1922.....	4,865,500*	5,923,200*	3,400,400*

*December estimated.

The German Industry

Satisfactory statistics regarding Germany are difficult to obtain. Official figures since the war on the output of pig iron and steel have only been issued through 1921 and nothing is available regarding 1922. The accompanying table, however, gives such data as are available with some estimates. According to fairly reliable computations Germany, as a result of the war, was stripped of approximately 40 per cent of her steel-making capacity based on the production in 1913, which included the output of Luxemburg. In that year the country's steel output was 18,935,000 tons. Today her capacity is reckoned at around 11,500,000 tons. If this be true, the country's output in the last two years has been about 75 per cent of her capacity. Such a record is nearly equal to that of both the United States and Great Britain. As in the case of Great Britain and the

United States the pig iron output is considerably below that of steel.

A feature of the 1922 history of the German industry has been the stupendous importation of scrap, which explains in part the relatively low pig iron production. Data for the first nine months show this movement to have been 48,580 tons per month.

As shown by the table, exports of iron and steel, which are now officially published, show an outgo of over 200,000 tons per month, placing Germany ahead of the United States and second only to Great Britain in its foreign trade in iron and steel. In view of the depreciation of the market, this record is a remarkable one and largely unexpected by the trade as a whole.

German Iron and Steel Output and Exports During Peace Years in Gross Tons

Germany	Pig Iron	Steel	Exports
1912.....	15,350,400*	16,075,200*	5,812,800
1913.....	16,476,000*	17,340,000*	6,202,800
1919.....	5,654,000	6,732,000	No data
1920.....	5,568,000	6,624,000	1,723,200
1921.....	6,096,000	8,700,000	2,445,600†
1922.....	6,200,000	8,750,000	2,489,116

*Excludes Luxemburg. Last four years partly estimated. †Based on 8 months.

The French Industry

The explanation of the record of France as a producing nation in pig iron and steel, as contrasted with Belgium, revealed in detail in the table, is probably due to the acquisition of Lorraine. Its pig iron production last year, estimated at 4,878,000 tons based on official figures for the greater part of the year, exceeds any records made since the war, and is nearly equal to the output in 1912 and 1913. The same statement is true regarding the output in steel. Had the devastated mills of northern France been fully restored the production would have been heavier.

French Iron and Steel Output and Exports During Peace Years in Gross Tons

France	Pig Iron	Steel	Exports
1912.....	4,860,000	4,356,000	498,000
1913.....	5,124,000	4,620,000	578,400
1919.....	2,376,000	2,148,000	232,800
1920.....	3,380,400	3,002,400	895,200
1921.....	3,363,600	3,054,000	1,462,400
1922.....	4,878,000*	4,351,000*	1,765,000*

*Partly estimated.

The striking feature, however, of the course of the French industry since the war has been the large increase in its foreign trade. At an estimated outgo of 1,765,000 tons in 1922, its foreign trade nearly equals that of the United States for the same year, and is nearly three and one-half times as large as its pre-war trade. The record of France in the last two years places her, as shown by the data, in the front rank of steel and iron exporting nations.

Late information is to the effect that the pig iron and steel output in October at 495,600 tons and 423,100 tons respectively reached the maximum figure since the end of the war.

The Belgian Industry

Contrasted with pre-war records, the course of the Belgian iron and steel industry has been erratic. Neither in pig iron or steel output or in foreign trade did the record last year approach that of the pre-war years. The recovery of the industry in Belgium has evidently been much slower than that of any other country. Probably the most interesting feature of the record last year of both France and Belgium is the fact that the pig iron production of both countries exceeded that of the steel, which is not true of the other three countries.

Belgian Iron and Steel Output and Exports During Peace Years

Belgium	Pig Iron	Steel	Exports
1912.....	2,304,000	2,472,000	1,494,000
1913.....	2,445,600	2,427,600	1,545,600
1919.....	247,200	328,800	174,000
1920.....	1,112,400	1,215,600	891,600
1921.....	861,600	780,000	910,800
1922.....	1,544,000*	1,454,600*	1,605,500*

*Partly estimated.

The fact that the 1922 exports make so good a showing is explained by the economic union between Belgium and Luxemburg, which became effective in the spring. They even exceed the pre-war years' record. This cannot be said of any of the other countries.

The most recent data show that the October, 1922, output of pig iron and steel was 172,000 tons and 179,600 tons respectively, or the highest for the year and the largest since the war.

The World as a Whole in Output and Exports

COMBINING the data of the five countries for pig iron, steel and exports for each year, some interesting comparisons are possible. The table shows the data, made up from the tables for each country, grouped by years and totals.

The outstanding fact, which these figures emphasize, is that in none of the four years since peace was declared has the world production of pig iron and steel or the world demand as represented by exports been as large as that before the war when measured by 1913 data. The same is true so far as 1912 is concerned.

In pig iron the United States, of course, still leads. While its output is still relatively low, it is credited last year with over 60 per cent in 1913. In 1919, 1920 and 1921, these proportions were 66 per cent, 67 per cent and 55 per cent respectively. In 1920 the world

World Production and Exports of Steel and Iron as Represented by the Five Leading Nations, in Gross Tons

Pig Iron:	1912	1913	1919	1920	1921	1922
United States	29,727,000	30,966,000	31,015,000	36,926,200	16,688,000	26,800,000
Great Britain	8,748,000	10,260,000	7,404,000	8,034,000	2,611,200	4,865,500
Germany	15,350,400	16,476,000	5,654,000	5,568,000	6,096,000	6,200,000
France	4,860,000	5,124,000	2,376,000	3,380,400	3,363,600	4,878,000
Belgium	2,304,000	2,445,000	247,200	1,112,400	861,600	1,544,000
Totals	60,989,400	65,271,000	46,676,200	55,021,000	29,620,400	44,287,500
Steel:	1912	1913	1919	1920	1921	1922
United States	31,251,000	31,300,000	34,671,600	42,133,000	19,783,000	34,350,000
Great Britain	6,792,000	7,688,000	7,896,000	9,067,200	3,625,200	5,923,200
Germany	16,075,200	17,340,000	6,732,000	6,624,000	8,700,000	8,750,000
France	4,356,000	4,620,000	2,148,000	3,002,400	3,054,000	4,351,000
Belgium	2,472,000	2,427,600	328,800	1,215,600	780,000	1,454,600
Totals	60,946,200	63,375,600	51,776,400	62,042,200	35,942,200	54,828,800
Exports:	1912	1913	1919	1920	1921	1922
United States	2,418,000	2,892,000	4,399,000	4,706,400	2,172,000	1,970,000
Great Britain	4,807,200	4,969,200	2,223,200	2,250,800	1,706,400	3,400,400
Germany	5,812,800	6,202,800	No data	1,723,200	2,445,600	2,489,100
France	498,000	578,400	232,800	895,200	1,462,400	1,765,000
Belgium	1,494,000	1,545,600	174,000	891,600	910,800	1,605,500
Totals	15,030,000	16,188,000	.....	11,467,200	8,697,200	11,230,000

production of pig iron was 84.3 per cent of that in in 1913; in 1922 the proportion was about 67.7 per cent.

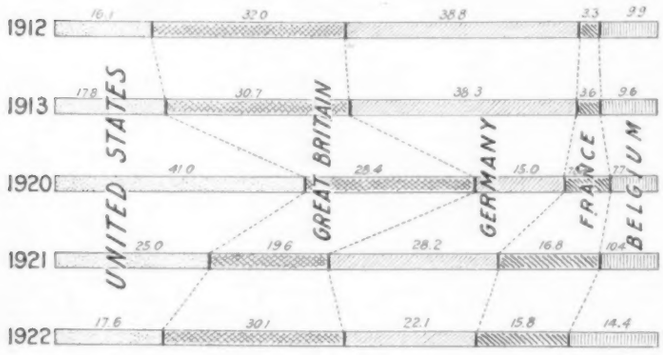
In steel, the showing for the world during the post-war years is more favorable than in pig iron—that is, the recovery has gone farther. Here again the United States is the leader, being credited with about 62.5 per cent of the world's total in 1922 as compared with 49.2 per cent in 1913. Only in 1921 has the American steel output fallen below that of 1913. In 1920 the world production of steel was close to that of 1913, due largely to the heavy outputs in Great Britain and the United States.

In exports "world hunger" for steel has not been satiated. The buying power of the large consuming countries is still weak. In no year since the war have the total exports approached those in 1913. In 1920 the world demand for pig iron and steel at 11,467,200 tons was only about 71 per cent of that in 1913 with the record in 1922 not quite so good. From a commanding position in 1919 and 1920 the United States in 1922 fell abruptly while Great Britain rose. Producing over 60 per cent of the pig iron and steel of the world in 1922, it exported only 17.5 per cent of the total and fell to third position, with Germany second and Great Britain first. The tremendous domestic consumption of iron and steel last year in the United States is realized when it is considered that, while the steel output exceeded that in 1913 by about 3,000,000 tons, the exports were only about 67.8 per cent of the pre-war year.

From the same source the output of pig iron and steel for the 17 producing countries of the world presents an interesting contrast with that of the five countries here discussed. The data for the entire world for 1913, 1920 and 1921 are as follows in gross tons:

	1913	1920	1921
Pig iron.....	77,296,000	59,051,000	33,279,000
Steel ingots and castings..	74,921,000	66,723,000	37,982,000

Comparing these figures with those for the five countries the striking fact is that in 1913 the output of the other 12 countries was large, swelling the world's total, whereas in 1920 and particularly in 1921, the 12 countries contributed very little to the total, especially steel.



Relative Exports of Iron and Steel from the United States, Great Britain, Germany, France and Belgium—These Five Being the Chief Sources of Supply for the Rest of the World. Data for two pre-war years and for three post-war years are compared. The diagram shows that the United States has lost, since 1920, more than half its great share of that year, Germany, France and Belgium being the chief beneficiaries

This analysis of the post-war years' data shows how the war and its readjustments have completely upset the normal course of production and trade prevailing in 1912 and 1913. In those years output and exports maintained an even trend. Since the war there has been no definite trend in any country. Where a gain has been made in one direction, a loss has been registered somewhere else. The phenomenally heavy use of scrap in steel making has been a feature and cut down the pig iron output. A prediction as to 1923, based on the record of the last four years, would be hazardous. Readjustments in prices of labor, raw materials and transportation are still necessary, and until these come the future is uncertain.

WAGE MOVE UPWARD

Weekly Earnings Rose 3.4 Per Cent in Three Months—Comparison with 1914

A nationwide survey of wage changes covering 400,000 wage earners in 23 industries just completed by the National Industrial Conference Board shows a substantial rise in hourly and weekly earnings in all classes of labor from July, 1922, to October, 1922. In only two industries, lumber and rubber, was there a decrease in hourly wages during this period. In automobile manufacturing and book and job printing, a slight decline took place in weekly earnings.

The average hourly earnings of all wage earners covered in this investigation were 23.8c. in July, 1914. In July, 1922, they had risen to 48.4c., in August to 48.6c., in September to 49.5c. In September, 1922, therefore, the average hourly earnings of all the wage earners covered were 108 per cent higher than in July, 1914.

The average hourly earnings of women show a far greater rise than for men above 1914 levels, in September, 1922, being 127 per cent above the pre-war figure. Skilled and unskilled classes of labor show practically the same increase in hourly earnings relative to 1914, though from July to September, 1922, the hourly earnings of skilled labor increased slightly more than those of unskilled.

The average weekly earnings of all wage earners, which were $12.27 in July, 1914, had risen to $23.09 in July, 1922, to $23.31 in August and to $23.88 in September. In the latter month, they were 95 per cent above the July, 1914, level. The average weekly earnings of unskilled labor appear to have increased more since 1914 and during July, August and September of 1922 than those of skilled labor. Average weekly earnings of unskilled labor in July, 1922, were 87 per cent above 1914 and in September, 1922, 95 per cent above pre-war levels, while those of skilled labor in July, 1922, were 86 per cent above 1914 and in September, 1922, had risen to 92 per cent above the July, 1914, level.

Employment in identical plants in the 23 industries covered in July, 1922, was 16 per cent above the July, 1914, level. In August, 1922, it was 18 per cent and in September 23 per cent above the pre-war figure, showing the steady improvement in employment conditions during the past summer.

The actual hours worked per week per wage earner also increased from 47.7 in July to 48.2 in September, although this figure is still below that for July, 1914. Plant hours and the nominal working week also improved steadily during July, August and September of this year, though these also were still considerably below the pre-war levels.

Taking into account the changes in the cost of living since 1914 and during July, August and September, 1922, this investigation shows that the "real" hourly earnings of all wage earners were 30 per cent higher in July, 1922, than in July, 1914, 33 per cent higher in August, 1922, and 34 per cent higher in September, 1922. "Real" weekly earnings were 21 per cent higher in July, 1922, 23 per cent higher in August, 1922, and 25 per cent higher in September, 1922, than in July, 1914.

Four Decades Monthly Output of Pig Iron

Daily Production Tonnage, from 1884 to Date, Compiled from Estimates of Capacity in Blast in the Earlier Years— Antedates Reported Figures by 18 Years

BY SIDNEY G. KOON

IT was brought out prominently at a recent New York meeting of the American Statistical Association that studies of business and other cycles increase in value with increasing frequency with which the data are collected. For many years business had had to depend largely upon annual figures for various commodities, particularly with regard to production statistics, and several speakers made it clear that figures compiled only once a year, or even figures compiled quarterly, were insufficiently elastic and insufficiently in detail to afford a real basis for the study of cycles. As the complete length of a cycle of business activity, crisis, depression and recovery averages not far from 40 months, figures at least as close as once a month must be had if a comprehensive study is to be made.

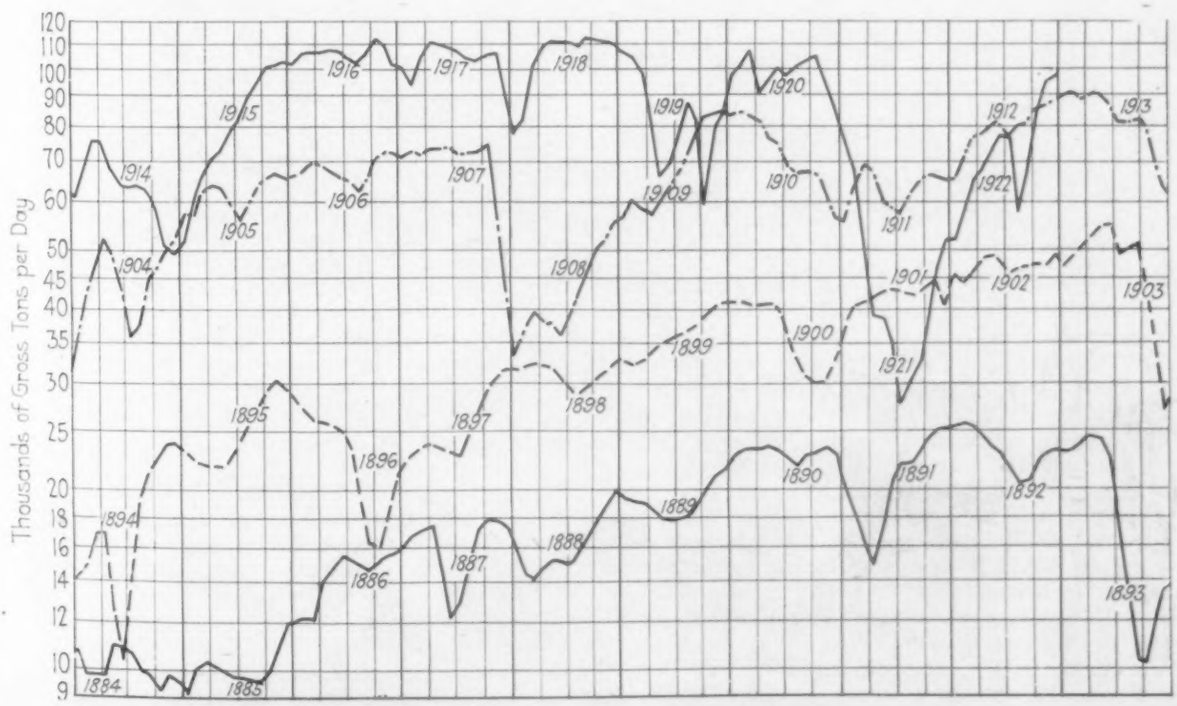
In the old days of cut-throat competition, when manufacturers were so jealous of each other that figures of production were unobtainable, estimates had to be made on the basis of such data as could be had, and these estimates were frequently unreliable and incomplete. In most cases, also, they were furnished too late to be of immediate use. This is not true of pig iron, thanks to the initiative of THE IRON AGE and the cooperation of the industry, but until late years it has been true of steel ingots, and even today the reports quoted monthly by the American Iron and Steel Institute on ingot figures are those of 30 companies only, instead of the large number of ingot producing organizations in the United States. The reporting companies cover about 85 per cent (last year as high as 87.5 per cent) of the industry's output.

Monthly figures for the production of pig iron first became available in the fall of 1901; for steel ingots, they started in the early summer of 1917. Previous to October, 1901, pig iron figures were quoted, not only by THE IRON AGE but by the American Iron and Steel Association (the predecessor of the institute), on the basis of the number of furnaces in blast at the first of each month and the estimated weekly capacity of those particular furnaces. These figures represented merely the rate at which iron was being made at each specified date. Scarcely more than 20 years ago, however, the editors of THE IRON AGE succeeded in inducing the iron producing interests of the country to report their figures once a month, showing the actual output of the month just elapsed. These figures were furnished in confidence and, since that time, have been compiled in the office of THE IRON AGE and have been published usually in the issue immediately succeeding the first day of each month.

How the Early Figures Were Obtained

Some months ago the statistician of the Federal Reserve Bank in New York, using the old IRON AGE figures of capacity in blast at the first of each month and an algebraic formula, derived figures for the monthly output of earlier years, in gross tons. Following out this idea in another way, figures have now been obtained by THE IRON AGE which are believed to represent very closely the actual output figures for every month from January, 1884, until the close of 1901, when actual production statistics first became available. This has been done in a simple manner, as follows:

The weekly capacity at the beginning of each month was averaged with the weekly capacity at the begin-



Four Decades of Coke and Anthracite Pig Iron—Daily Output Figures

Monthly Production of Coke and Anthracite Pig Iron for 39 Years

Expressed in Gross Tons per Day

Year	January	February	March	April	May	June	July	August	September	October	November	December	Year's Average
1884	10,613	9,690	9,710	9,719	11,032	10,833	10,774	10,065	9,800	9,226	9,800	9,645	10,078
1885	9,167	10,039	10,317	10,101	9,951	9,734	9,734	9,667	9,601	9,948	10,884	12,083	10,103
1886	12,032	12,281	12,161	*14,106	*15,097	*15,670	15,387	15,097	14,692	15,226	15,670	*15,806	*14,446
1887	*16,303	*16,944	*17,233	*17,504	14,987	12,267	13,027	15,341	17,319	*17,944	17,928	17,292	*16,167
1888	16,181	14,469	14,271	14,941	15,423	15,078	15,108	16,013	16,799	17,785	*19,038	*20,052	*16,271
1889	19,388	19,128	19,150	18,806	17,984	17,777	18,112	18,251	18,806	*20,199	*21,400	*22,050	*19,256
1890	*23,202	*23,640	*24,011	*24,084	*24,112	23,700	22,639	22,359	23,204	23,620	23,994	23,324	*23,492
1891	20,714	18,451	16,272	15,002	17,327	21,217	22,779	22,677	23,381	*24,601	*25,257	*25,326	21,104
1892	*25,495	*25,873	25,744	24,707	23,802	23,181	22,080	20,839	20,987	22,398	23,690	23,904	*23,550
1893	23,655	23,934	24,503	24,836	24,537	22,610	17,940	12,973	10,579	10,380	12,264	13,719	18,459
1894	14,121	14,960	16,939	16,954	12,251	10,471	14,377	19,033	21,570	22,529	23,864	24,276	17,630
1895	23,172	22,417	22,067	22,005	21,941	23,029	24,695	*26,030	*27,768	*29,383	*30,442	29,733	*25,263
1896	28,196	26,899	26,169	26,207	25,820	25,063	23,210	19,583	16,347	16,044	18,304	20,818	22,715
1897	22,535	23,278	24,008	24,169	23,963	23,557	23,291	24,719	27,183	29,172	*31,012	*31,926	*25,746
1898	31,843	*32,401	*32,689	32,578	31,948	30,736	29,424	29,144	29,830	30,993	32,394	*33,435	*31,444
1899	*33,466	32,497	33,087	*34,609	*35,189	*36,050	*36,930	*37,238	*38,017	*39,422	*40,634	*41,013	*36,537
1900	*41,333	41,252	40,652	40,750	41,260	40,398	36,625	32,944	31,424	30,265	30,777	33,237	*36,725
1901	37,689	40,694	*41,485	*42,110	*43,427	*44,141	43,439	42,677	42,913	*44,587	*45,398	40,845	*42,452
1902	*46,377	44,915	*46,613	*49,182	*49,769	48,225	46,512	47,360	47,287	47,772	47,763	49,589	*47,669
1903	47,509	49,665	*51,305	*53,614	*55,278	*55,774	49,877	50,681	51,791	45,989	34,654	27,313	*47,759
1904	29,717	41,567	46,680	51,842	49,463	43,068	35,684	37,667	45,089	46,944	49,554	52,129	43,845
1905	*57,424	57,048	*62,460	*64,068	63,346	59,776	56,191	59,473	63,317	*66,231	*67,121	65,991	*61,915
1906	66,738	*68,001	*69,859	69,107	67,701	65,891	64,948	62,153	65,699	*70,865	*72,922	72,107	*67,995
1907	71,149	*73,038	71,821	*73,975	*74,049	*74,897	72,763	72,594	72,783	*75,386	60,938	39,815	*69,350
1908	33,718	37,163	39,619	38,289	37,603	36,444	39,287	43,851	47,300	50,554	52,595	56,158	42,736
1909	57,975	60,976	59,232	57,962	60,753	64,656	67,793	72,546	*79,507	*83,856	*84,917	*85,022	*69,618
1910	84,148	*85,616	84,459	82,792	77,102	75,516	69,305	67,963	68,476	67,520	63,659	57,349	*73,577
1911	56,752	64,090	70,036	68,836	61,079	59,585	57,841	62,150	65,903	67,811	66,648	65,912	63,868
1912	66,384	72,442	77,591	79,181	81,051	81,358	77,738	81,046	82,128	*86,722	*87,697	*89,766	*80,283
1913	*90,172	*92,369	89,147	91,759	91,039	87,619	82,601	82,057	83,531	82,133	74,453	63,987	*84,176
1914	60,808	67,453	75,738	75,665	67,506	63,916	63,150	64,363	62,753	57,361	50,611	48,896	63,149
1915	51,659	59,813	66,575	70,550	73,015	79,361	82,691	89,666	*95,085	*100,822	*101,244	*103,333	81,267
1916	102,746	*106,456	*107,667	107,592	*108,422	107,053	104,017	103,346	106,745	*113,189	110,394	102,537	*106,665
1917	101,643	94,473	104,882	111,165	110,238	109,002	107,820	104,772	104,465	106,550	106,859	92,997	104,619
1918	77,799	82,835	103,648	109,607	111,175	110,793	110,354	109,341	*113,942	112,482	111,802	110,762	105,496
1919	106,525	105,006	99,685	82,607	68,002	70,495	78,340	88,496	82,932	60,115	79,745	84,944	83,789
1920	97,264	102,730	108,900	91,327	96,312	101,451	98,931	101,529	104,310	106,212	97,830	87,222	99,492
1921	77,945	69,187	51,468	39,768	39,394	35,494	27,889	30,780	32,850	40,215	47,183	53,196	45,325
1922	53,063	58,214	65,675	69,070	74,409	78,701	77,592	68,586	67,791	85,092	94,990	.....	.....

*Indicates a new high record figure.

ning of the following month, and assumed to be the average weekly rate of production for the intervening month. Dividing this by 7 and multiplying the quotient by 30 (or 31, 29, 28) gave the first approximation to the output for the month. The twelve monthly figures thus obtained for each year were then added and compared with the annual figures for that year, as published by the American Iron and Steel Institute. In some cases the closeness with which the figures checked was remarkable. Thus, in 1891, the official figure of the institute was 7,702,906 tons, while the figure obtained by the above calculation was 7,702,986 tons, a difference of only 80 tons in nearly 8,000,000 tons. In many other cases the divergence was less than 1/10 of one per cent.

Months in Which New High Records of Daily Output of Pig Iron Have Been Made

January	1887, 1890, 1892, 1899, 1900, 1902, 1905, 1913
February	1887, 1890, 1892, 1898, 1906, 1907, 1910, 1913, 1916
March	1887, 1890, 1898, 1901, 1902, 1903, 1905, 1906, 1916
April	1886, 1887, 1890, 1899, 1901, 1902, 1903, 1905, 1907
May	1886, 1890, 1899, 1901, 1902, 1903, 1907, 1916
June	1886, 1899, 1901, 1903, 1907
July	1899
August	1895, 1899
September	1895, 1899, 1909, 1915, 1918
October	1887, 1889, 1891, 1895, 1899, 1901, 1905, 1906, 1907, 1909, 1912, 1915, 1916
November	1888, 1889, 1891, 1895, 1897, 1899, 1901, 1905, 1906, 1909, 1912, 1915
December	1886, 1888, 1889, 1891, 1897, 1898, 1899, 1909, 1912, 1915

On the other hand, of course, there were cases where the difference, particularly in the earlier years, amounted to 3 or 4 per cent. Corrections were then made to the estimate of the month's production, due allowance being made for the differences in length of the various months, and figures finally obtained which, while not published here because of lack of space, are regarded as the most reliable compilation extant of early pig iron output by months.

In the table given in connection with this article these figures have been translated into figures of daily output, by dividing the monthly figures by the number of days in the month. This makes them comparable with the figures published month by month in THE IRON AGE and with the monthly chart of pig iron output. And the figures from the table have been expressed in a diagram showing four decades of month by month pig iron production in the United States.

It should be explained that the figures given represent the coke and anthracite output, and that they wholly ignore charcoal iron, the production of which has not been compiled by THE IRON AGE for some years because of the small quantity of such production and the difficulty of assembling complete figures from the relatively small units producing this iron. As the charcoal iron output in 1921 was only 94,730 tons out of a total of 16,688,126 tons, it is evident that this dwindling, small element may be neglected without serious error. This was not the case to the same extent in the earlier days. Thus, in 1884, the charcoal iron output was almost exactly 10 per cent of the total. The ratio dropped rapidly, however, until ten years later it was only one-third as great, and it dropped below the 1 per cent mark in 1915. In any case, however, charcoal iron has been omitted from the figures and diagram.

For comparative purposes, and because it can be better so depicted, the four decades in the diagram have been superposed one upon the other. This has had certain advantages in showing a definite parallelism between large portions of the four traces across the page. Each one shows a fairly steady gain as indicated by the general upward trend of the lines from left to right. This method of analysis shows also the tremendous shock of the 1921 slump in iron. As will be seen from the curve, production in that year came very close to the 1891 figures of 30 years before.

Successive High Records

There were three years immediately preceding 1884 which showed a larger total iron output than did 1884. It is fair to assume, therefore, that none of the months of 1884 gave a new high record of production. With the heavily increasing output in the spring of 1886, however—a year in which the increase over the preceding year was more than 40 per cent, while the increase over the largest year which had preceded it was about 23 per cent—new records undoubtedly were made. Thus

in the table an asterisk will be found set opposite the 14,106 tons representing the daily output for April of that year. Similarly, asterisks are scattered down through the table whenever any month showed a figure higher than any which had gone before. The latest of these high records was September, 1918, with 113,942 tons per day, or almost precisely 100,000 tons more than were obtained in the record-breaking month of 32 years earlier. The new figure is more than eight times the old and it may be said fairly that during the interval an eight-fold expansion took place in the pig iron producing capacity of the United States.

On the basis of the figures given, the first month to show an average daily output of 20,000 tons or better was December, 1888. The 30,000-ton mark was first passed in November, 1895, 40,000 tons four years later, while 50,000 tons was reached first in March, 1903. It was not until October, 1907, that we found an output of 75,000 tons per day, while the first 100,000-ton mark came in October, 1915. Every month of 1916 and all but two in 1917 and two in 1918 showed more than 100,000 tons, but it is more than two years, now, since 100,000 tons has been recorded.

In 1899 no fewer than ten of the twelve months showed new high records, nine of these being consecutive and covering the last nine months of the year. Together with January, 1900, also a record, the group of ten successive high record months is the longest known. Eight successive months from October, 1889, to May, 1890, provided the second longest group; no other exceeded five months. And no calendar year, save 1899 and 1901, had more than five high record months, 1901 having six.

More new high production records, on the basis of tons per day, have been made in October than in any other month—13 in 39 years. November, with 12, and December, with 10, are next. February, March and April show 9 each; January and May, 8 each; June and September, 5 each; August has 2 and July only 1. This is shown graphically in the accompanying table, which indicates the months and years of the record tonnages.

Both the diagram and, to a less marked degree, the main table show many sharp curtailments and an equal number of recoveries. Ordinarily, a drop is sharper than the subsequent regaining of normal output. Particular attention may be called to the sharpness of the slumps in 1887, 1891, 1893, 1894, 1896, 1903, 1907 and 1921. In a similar way, noteworthy recoveries were made in 1885, 1887, 1891, 1893, 1894, 1904, 1908, 1915 and to a lesser extent in 1922. In 1894, in particular, the recovery was exceedingly rapid, a gain of more than 37 per cent being made in the one month following June, this gain reaching almost 82 per cent in the two months and about 106 per cent in the three months. About equally abrupt was the drop from October, 1907, to the following January, the October figure being no less than 123 per cent greater than that recorded three months later.

A Year's Achievement in Machine Tools

Many New Machines Developed—Importance of Accuracy Emphasized—Automatic Movements Replacing Many Hand Operations

BY L. S. LOVE

IN scanning the progress made in the development of machine tools during 1922, there seems to be a predominance of three factors.

The first of these is the demand for accuracy, coupled with large production. It is not assumed that in the past the question of accuracy has been slighted, for in many cases machines built years ago attained precision and ability to maintain that precision.

However, the demands made by the automobile industry in the first place called for production from machine tools under conditions that were considered at that time incompatible with accuracy. Gradually a point was reached by production machinery, where a requirement of plus or minus 0.001 in. was met, later developing to the point where limits of plus or minus 0.0005 in. were not uncommon. The war conditions, through which the machine industry had most unusual demands made upon it, have had a lasting effect on this question of accuracy. Naturally, owing to the exigencies of war, the question of production, and tremendous production at that, was foremost. Coupled with this, however, was the need for an accuracy hitherto unknown on large quantity work. In some instances, the limits set were carried as far as six decimals. Due to this demand, the machine industry became accustomed to thinking in ten thousandths, instead of merely in thousandths of an inch, and at the same time bore in mind the fact that the work must be turned out in large quantities. This situation lasting through a term of years has, in the nature of things, caused a similar demand since then from producers of machined metal products, the consumers of machine tools, upon the manufacturers of such machines, so that the products of such consumers may continue to be turned out in large quantities, without any sacrifice of accuracy. In other words, war work taught the industry how to really inspect and test work for accuracy or interchangeability, with the consequent demand for machines which would deliver accurate work in quantities.

New Measuring Devices for Accuracy

The demand for accuracy is shown in the development of new measuring devices which will register on commercial work to 0.0001 in., when necessary. These instruments, in turn, are backed by standards kept at uniform temperature, which will check accuracy to limits of 0.000001 in. It is, of course, ridiculous to suppose that any machine, no matter how accurately built, will turn out work of this nature unless the machine is properly set up on a proper foundation and then rightly cared for. To this end there have appeared on the market levels of extreme accuracy and of suitable size for the purpose, intended principally to be of service to the purchaser of machinery to enable him to secure from it by proper setting up the accuracy and long service which most machine tool builders are trying to build into their machines.

As a part of the educational campaign toward maintenance of accuracy in the care of machine tools, after they have been properly set up and put into operation, is the attention manufacturers are giving to the question of oiling. This is taking two forms: that of greater use of the flood or cascade lubrication principle, doing away to a large extent with the need for frequent attention on the part of the operator; the other is the more extensive use of centralized oiling systems, which obviate to a great extent any chance that the operator might omit the care of any one bearing. In some cases

bearings are jacketed for circulation of cooling oil, thereby helping the oil actually used for lubrication to save the bearing.

Simpler Machines Found More Economical

The second predominating tendency would appear to be toward a marked simplicity in design of machine tools generally and automatic machines in particular. When automatic machines first appeared, the aim seemed to be to make them quite universal in their application to different classes of work. To quote one user of automatic machines recently interviewed: "The idea of designers seemed to be comparable with that of an employer, who might expect a good truckman, or roustabout, to be a good toolmaker."

The simplification has taken the form of machines suitable for a variety of work, but work in the same general class, providing flexibility without the weakening effects of universality.

Further, there is a distinct tendency toward machines which do not require a heavy outlay for special tools or other accessories, which in some cases in the past have cost considerably more than the machines themselves. Also the desire now is to save time in changing a set up from one job to another. This saving is emphasized in the simpler types of machines. The elimination of the human element is another big factor in this question of the use of automatic machinery and its more simple design. The average so-called machinist of today is not the high class worker of earlier days and has not the mental capacity to understand the more complicated machines. Nor does he take the interest in his work, his chief idea seeming to be to do as little as possible and get as much as possible for doing it, rather than having a pride in his ability to turn out a workmanlike job of the highest class, doing work well because he takes an interest in it.

In line with this labor situation, in some localities floaters and drifters have again appeared, adding not only to the difficulty of producing work continuously with the help of men acquainted with conditions in any particular shop, but increasing costs again all down the line, bringing us inevitably back to our old friend or enemy, the constantly mounting, already high, cost of living. This condition of course is largely brought about by the constant agitation of labor leaders working on an element naturally disposed to dissatisfaction with existing conditions and a general lack of interest in work as an institution.

While having nothing to do with the trend in machine-tool development, a quotation from one employer of machinists might be in order: "Labor leaders should be paid, as is the doctor in China, to keep the system working; whether labor system or human system is immaterial. It should be kept working. When it stops, pay should stop. During a strike the labor leader in that industry should receive nothing, or possibly $6 a week."

The new foreign element which has been working into the machinist trade for a number of years past is composed of nationals not mechanically inclined. Many of these men are developing a mechanical sense which tends to stimulate latent talent and strong development through association with Americans and former foreigners around them in the shop and through intermixing with others more mechanically inclined. The tendency toward clannishness, which is natural, is not encouraged, and is largely avoided by not permitting nationals to segregate to any one occupation in the shop. By avoiding this segregation, attempts at arrogance on the part of those engaged in any one occupation in the shop are circumvented.

Bulk of Year's Business in Cost Saving Machines

Partly because of the attitude of labor, its high cost and low quality, and to help to combat this situation, the bulk of what business has been done in the last year has been in improving means of securing the same production at a lower labor cost. To this end many of the simpler types of automatic machines have been originated or modified. While the use of single purpose or special machines is markedly diminishing, these are still being used. Frequently such a machine will be developed to handle the second operation on work coming from automatic screw machines, if the continuity of the work should seem to warrant expenditure for the development of a single purpose machine. Those that have been developed are chiefly automatic or semi-automatic and are heavier than in the past, the aim being to make a machine sufficiently rigid to hold the tool in its place and continue cutting to size, regardless of chips which may build up on the cutting edge.

Standard Types of Machines With Special Fixtures Favored

As a general thing, the third predominant factor is the distinct leaning toward use of standard types of machine tools, equipped with special attachments making them suitable to handle work economically in a manner which compares favorably with the single purpose or special machine. Such standard machines have several advantages. They are more flexible, as the tooling equipment can readily be changed from one job to another, as conditions in the shop change; thereby, rather than having a large section of the shop standing idle, permitting the whole shop to be used. When properly tooled, the standard machine is a big producer.

Another advantage is the fact that the standard machine has a distinct second hand value. The war brought enthusiasm for and belief in special machines for single purpose work. There has been, this last year, a very decided reaction from that attitude, partly because such specials having nothing but a scrap value when their usefulness is served in a particular shop employing them. This has largely helped the growth in favor of standard equipments. Further, such standard tools, beside accomplishing in most cases as much as any special could, are built in large lots and can consequently be built at a lower cost.

In a number of cases manufacturers have taken to building machines with a more or less flexible equipment in the way of tool slides and other modifications. These can all be standardized, although care must be taken not to carry the standardization too far and vitiate the desirable features of flexibility, thereby checking the progress which seems to be under way.

Early in the year the demand for radio equipment promised a decided improvement in the machine-tool business. This spurt did not develop to the extent anticipated, although it did have a decided effect in getting the automatic screw machine branch of the industry again under way, though it, of itself, produced no new development in design of automatic screw machines.

Improvement in Motor Drives

One of the interesting phases of machine-tool design is the recent tendency to incorporate motor drives as a part of the machine design, rather than as an attachment. Heretofore, machines were designed with a belt drive arrangement specifically in view, and the motor drive was considered of secondary importance from the standpoint of the designer.

Trend Toward Motor-Driven Machines

This idea seems to have been reversed, with the trend now toward motor-driven machines of more compact and symmetrical design, with provision for belt-drive feature borne in mind but not of prime importance as formerly.

Due to the improvement in the manufacture of gears, these are being used more and more, even where noise is to be avoided and accuracy of operation desired. The improvement in gears is secured through grinding in some cases; in others, through burnishing after hardening, which gives elements of ground gearing but not quite the accuracy nor long life of the ground tooth. This increasing use of gears in machine tools has brought the automobile type of transmission into marked evidence in machine tool drives.

(To be concluded)

1922 Ends with Good Promise for Early 1923

(*Continued from page* 3)

Labor Conditions

The iron and steel industry itself was exempt from strikes in 1922, but a surprising development, in view of the great concern throughout the country over unemployment in the fall of 1921 and in later months, was a shortage of common labor in many districts. As early as May sporadic labor shortages were reported, the steel companies in the Chicago district, in particular, finding difficulty in getting men for some classes of work. Foreign born workmen returning to Europe were more numerous than were immigrants of the sort needed for some of the harder manual labor at steel works.

In August the United States Steel Corporation announced a 20 per cent advance, effective Sept. 1, in the wages of day workmen at its plants, thus making the rate for common labor 36 cents an hour. Like action was taken by independent companies. At Eastern mills which had had a 25-cent basis for more than a year, the advance was to 30 cents an hour. Later in the year, as the common labor scarcity was more in evidence in the Central West, there were rumors of a further wage advance; but the steel industry, with its costs in fuel and labor rising, and with only a 10 per cent reduction in rail freights on July 1, instead of the 28 per cent for which it asked, was in no position to put wages still higher. There was criticism from other industries on account of the 20 per cent advance, but it was forced by conditions over which the steel companies had no control.

In May President Harding invited 40 representative iron and steel manufacturers to a dinner conference at the White House, and asked them to consider what could be done toward the abolition of the 12-hr. day in the industry. At the meeting of the American Iron and Steel Institute in New York, on May 26, President Gary appointed a committee of nine to make a thorough investigation of the question and report its findings to President Harding. The committee's inquiry is still under way. In appointing the committee, Judge Gary said to the institute: "Let us commence the investigation with a determination to find ways and means of getting rid of the 12-hr. day."

Great Efforts for Consolidation

One year ago it was said in THE IRON AGE that the proposal to consolidate a number of independent steel companies was likely to come to actual accomplishment. A seven-company merger was then being worked upon and those conducting the negotiations were free in making public their plans. The seven companies were the Midvale Steel & Ordnance Co., the Lackawanna Steel Co., the Youngstown Sheet & Tube Co., the Republic Iron & Steel Co., the Inland Steel Co., the Steel & Tube Co. of America and the Brier Hill Steel Co. Their total annual capacity was put at 10,129,000 tons of ingots, or nearly 20 per cent of all in the country.

The even proved that the unusual willingness of those planning the merger to acquaint the public with every step they took was in part responsible for defeating their aims. On May 11, after more than five months of publicity concerning the seven-company consolidation and just as a formal statement of its consummation was expected, President Grace of the Bethlehem Steel Co. announced that his company had acquired the properties of the Lackawanna Steel Co. The following week, or on May 19, President Campbell of the Youngstown Sheet & Tube Co. stated that his company would not participate further in the negotiations for consolidation. Later it was announced that the Midvale, Republic and Inland companies, three of the original seven, would continue their negotiations, and early in June a plan for their merger under the name of the North American Steel Corporation was agreed upon.

Meanwhile a resolution by Senator LaFollette passed the Senate, calling upon the Attorney General to report on the legality of the Bethlehem purchase of Lackawanna and of the proposed Midvale-Republic-Inland merger. The Attorney General reported late in July that the Bethlehem purchase of Lackawanna would be neither an actual monopoly nor even an attempt to monopolize; also that the merger of the Midvale, Republic and Inland companies, being designed to reduce overhead, eliminate unnecessary sales agencies and thus better to compete with the United States Steel Corporation, would not be in restraint of trade but rather in furtherance of trade.

However, the Federal Trade Commission, which for some weeks had been investigating the proposed merger, took a different view from that of the Department of Justice. On Aug. 31, by a majority vote, the commission decided to issue a complaint against the three companies which sought to consolidate in the North American Steel Corporation, holding that such consolidation would be in violation of section 6 of the Federal Trade Commission act. On Sept. 28 the heads of the three companies issued a statement at New York to the effect that while eminent counsel had advised that the consolidation was entirely legal, the delay entailed by the Federal Trade Commission complaint made it inadvisable to proceed and therefore the plans had been abandoned.

Bethlehem Acquires Midvale

The Federal Trade Commission also issued a complaint against the Bethlehem Steel Corporation for its purchase of Lackawanna, and hearings under this complaint are still pending. The Bethlehem interests gave the steel trade a second surprise by the announcement on Nov. 24 that, subject to ratification by the stockholders of both companies, it had purchased the Midvale Steel & Ordnance Co. This, with the Lackawanna capacity, would give Bethlehem about 15 per cent of the steel ingot output of the country, or 7,600,000 tons a year. It is expected that the Midvale purchase will be consummated about Feb. 15.

In the last week of the year it was stated at Youngstown, Ohio, by the heads of the Youngstown Sheet & Tube Co. and the Brier Hill Steel Co., that a plan had been practically agreed upon for a union of the two companies. Negotiations had been under way two months before, but at that time it had been decided not to unite. The merger will obviate the proposed expenditure of $8,000,000 by the Brier Hill company to round out its finishing capacity.

At Chicago a plan for the bringing together of the Inland Steel Co. and the Steel & Tube Co. of America through the purchase of one by the other was being worked upon as the year ended.

Pittsburgh Plus

In the famous Pittsburgh basing case before the Federal Trade Commission a great mass of testimony has been taken in the past year before an examiner at Washington. The complaint is directed against the Steel Corporation and its subsidiaries only, though independent steel companies intervened in the original case in which hearings were conducted in 1919 and 1920. The effort of Trade Commission attorneys in the hearings of 1922 has been to link up the Steel Corporation and the Pittsburgh base price with the old-time trade practices in connection with pools and other agreements. Much of the testimony on these matters presented in connection with the Steel Corporation dissolution suit has been gone over again. The case promises to be long

drawn out. Whatever its outcome, it is expected that the Supreme Court will finally pass on the issues involved.

A Year of Scant Profits

Notwithstanding a volume of business nearly 70 per cent greater, 1922 showed little better financial returns for a number of important steel companies than 1921. The Steel Corporation's earnings are not a gage for the entire industry, in a comparison of the two years—in part because it carried over a large volume of orders from 1920 to 1921, while the leading independent companies carried over little, and in part because the corporation can make more money on a given market price than its competitors. In 1921 the corporation's first quarter earnings were by far the best for the year; for 1922 the fourth quarter, with the largest output of all, is expected to make the best showing. It is notworthy that the net earnings for the first three quarters of 1922, at $74,095,000, were only $1,000,000 more than for the first three quarters of 1921. In the first quarter of last year a part of the preferred dividend was paid out of surplus. In the second and third quarters the payment of the common dividend required the taking of but $1,462,345 and $1,339,602, respectively, out of surplus. Some of the independent companies showed heavy deficits. For the first three quarters the Midvale Steel & Ordnance Co. had a deficit of $3,348,000, as compared with a deficit of $3,934,000 in the first nine months of 1921 and a balance of $10,314,000 in the same period in 1920. The Republic Iron & Steel Co., which suspended dividend payments on its preferred stock for the entire year, had a deficit of $764,376 in the first nine months of 1922, compared with a deficit of $3,939,972 in the first three quarters of 1921. The Lackawanna Steel Co.'s deficit for the first half of the calendar year 1922 was $652,852, against $974,392 in the first half of 1921.

The Year in Pig Iron

A glance at THE IRON AGE pig iron composite shows that although the year began with the price trend downward, there was an almost continuous movement upward for six months from early in April, when the effects of the coal strike began to be felt. Basic, for example, which was quoted at $20, Valley, in April, steadily advanced until $32.50 became the top of the market in September, and one sale of 20,000 tons was reported at $34. Then prices started downward, touching $25 early in December, but advancing to $27 at the close of the year. Southern iron in March, 1922, descended to the lowest level since November, 1916, but in the later weeks of the railroad strike, shortage of Southern iron developed and as high as $30 was quoted. Few sales were made at that price and within a few weeks there was a drop of $7 per ton. The year witnessed the remarkable range of $15 in March to $30 in September.

Two very unusual developments of the fall were the shipment by boat from Buffalo to Chicago of about 12,000 tons of pig iron and shipment by boat of 10,000 tons from Duluth to Buffalo, of which a considerable part of the tonnage was sold to New England melters.

After the settlement of the railroad and coal strikes, the market lagged until a buying movement in early December was started by radiator and cast iron pipe companies and a large volume of business was transacted. The buying was, however, to a very large extent for delivery in the first quarter of 1923, and neither buyers nor sellers have been anxious to contract beyond that date. At the close of the year, foundries as a rule were actively engaged, and the outlook for the first three months of the new year was very encouraging. Slow deliveries, high costs and high prices, which prevailed throughout the strike period, were features of the year. Deliveries are now being made in a fairly satisfactory manner, but the prices of coke are high and costs are not such as to encourage the blowing in of furnaces. The one great source of apprehension is that there will be serious labor troubles in the coal mines when the present contracts expire on April 1. It is generally recognized that the miners were victorious in their last fight and that the operators will contest a continuance of present conditions of employment, especially as to the obnoxious check-off system. Predictions are freely made that the country will not tolerate another prolonged strike of coal miners.

The importation of pig iron, particularly from Great Britain, was an important feature of the year and undoubtedly checked the upward trend of prices, which otherwise might have developed into a runaway market. Up to Sept. 21 the receipts of foreign iron in this country amounted to only 109,000 tons, and Government figures since that date are not available. The movement was heavy in the last three months of the year, and it is probable that the total imports, excluding ferroalloys, amounted to 300,000 to 350,000 tons.

Foundry Operations

At the close of 1922 the average foundry operation in the country was about two-thirds of the capacity, which would mean practically 100 per cent of 1913 capacity. For the entire year 1922 the average operation in all foundry lines was around 40 per cent. Steel, malleable and light gray iron shops were running close to 100 per cent as the year ended, while gray iron shops doing medium and heavy work were at 40 per cent of capacity. Foundries having to do with radiation, heating furnace and automobile work have had record years, and those working on sanitary appliances and builders' hardware have also done particularly well. Today deliveries that can be had on steel castings range from 60 to 90 days. Both steel and malleable foundries have heavy orders from car builders, and there is much work in malleable shops from automobile manufacturers.

Lake Superior Ore Record

Although early in 1922 it was estimated that the movement of Lake Superior ore would not exceed 35,000,000 tons, the lake movement was 42,613,184 gross tons. This was a gain of 90.6 per cent over 1922, but was well below the war period, when shipments exceeded 60,000,000 tons in three successive years, the maximum being 64,734,198 tons in 1916. The all-rail shipments are estimated at 1,250,000 tons. The ore buying season started very late, prices not being named until June 9, when they were reduced 50c. a ton, making Mesabi non-Bessemer $5.05, a decline of $1.50 from the peak prices of 1920. A serious labor situation existed in Lake Superior mining districts at the close of 1921. Owing to the greatly reduced operation of iron and steel plants, few mines were being operated. After the long unemployment, many miners were in need and a large number of mines were started to give them employment. It was necessary, however, to make sharp reductions in wages. As conditions improved, work was resumed in other mines, and in May the wage scales which prevailed in the latter part of 1921 were restored. In September the Steel Corporation made a wage advance of 10 to 15 per cent, and independent companies soon took similar action. Labor shortage began to be felt in the mining country in September and still exists. With restricted immigration, a scarcity of mine labor is expected in the coming season. The belief among ore men is that ore prices will be higher this year to make up for wage advances, other increased costs of mining operations and high rail freights.

Concentration of lean magnetites has been begun on a commercial scale by the Mesabi Iron Co., which will ship all winter by rail. Its capacity will be much increased for the next season. Wash concentration of

sandy Mesabi ore is up to 10 per cent of the total shipments from that range, with present capacity of washeries for 10,000,000 tons a season. It seems probable that there will be other magnetic separation installations and that the next ten years will witness a decided change in proportionate shipments of natural as compared with beneficiated ores. Experiments with 100-ton cars made the past year will lead to their more general introduction, and the tendency toward bigger cars, heavier stripping apparatus, larger docks and other large equipment is marked. This is due to high wages and scarcity of men. Very little has been done on the Cuyuna range, except in manganiferous open-pit mines. The use of this ore in basic open-hearth practice grows. Explorations in progress in the Lake Superior region are few and mostly elsewhere than Minnesota. The Ford Motor Co. is exploring near Michigamme Mountain, and the Bethlehem Steel Co. in the Nipigon region. New tonnage developed during the year has been insignificant. Shafts to go down 4000 ft. and to be the deepest for iron ore anywhere are being started at Geneva and Eureka, Gogebic range.

Imports of iron ore for the year to Sept. 21, when the new tariff law became effective, amounted to 662,418 tons.

Iron and Steel Exports

Commonly 1922 has been counted a poorer year than 1921 in exports of steel products, and the statistics of the Department of Commerce would seem to bear out that view, the total of iron and steel shipments out of the country to the end of October being 1,710,133 gross tons, against 1,953,414 tons in the first ten months of 1921. But it is to be considered that about 1,300,000 tons of the shipments of 1921 represent orders on the books at the end of 1920. With this large carry-over, the 2,213,000 tons exported in 1921 show that only about 900,000 tons of that year's movement was business originating within the year. On the other hand, very little export business was on the books of the steel companies at the opening of 1922. Thus the 1,970,000 tons now estimated as the iron and steel exports of 1922 show that much more new business was taken for export in the past year than in 1921—probably a matter of 1,600,000 tons, as against the 900,000 tons booked in 1921.

Canada for a good while has been taking about one-third of our exports. Last year Canada and Japan were the main dependence of exporters of steel products. For the ten months ending Oct. 31, Japan took 160,000 gross tons of black sheets and 123,000 tons of steel rails. The use of sheets in Japan, many of them being galvanized there, has continued to grow on the lines indicated in an article on this subject in THE IRON AGE of Jan. 26, 1922, page 274.

A significant development in 1922 in connection with the export trade in steel was the announcement made in September that the Consolidated Steel Corporation, formed at the close of 1918 to handle the export business of a number of independent steel companies, had decided to liquidate its affairs. Some of the companies represented in the organization, particularly the Bethlehem Steel Co., following its acquisition of the Lackawanna Steel Co.'s plant at Buffalo, decided to handle their Canadian business themselves. As Canada was so important a field for the export corporation, its elimination made the expense of conducting foreign business prohibitive, particularly with the buying power of countries on other continents so much curtailed, as has been the case for two years. In 1919 and 1920, the Consolidated Steel Corporation for many months did business at the rate of fully 1,000,000 tons a year. Only a fraction of this amount was done, however, in 1922. The general statement was made in explanation of the decision to liquidate, that "present costs prevent the company from competing for business abroad."

The Bethlehem Steel Corporation has formed the Bethlehem Steel Export Corporation to handle its export trade and others of the companies which have been associated in the Consolidated Steel Corporation under the provisions of the Webb Act will continue to market a portion of their product abroad, probably through long established companies engaged in the general export trade.

The following table shows how the 1922 export shipments of iron and steel products which are stated in the statistics in tons compared with those of previous years:

Exports of Iron and Steel, Gross Tons

	1918	1919	1920	1921	1922
January ...	495,345	360,456	333,601	547,394	160,920
February ..	440,532	234,793	308,185	393,328	133,975
March	382,195	344,506	417,216	230,635	208,843
April	465,865	408,204	395,120	162,592	198,830
May	493,241	447,050	420,359	142,551	230,062
June	421,963	544,580	402,707	119,081	212,295
July	457,233	287,823	458,866	86,523	157,169
August	511,858	396,743	431,484	75,827	145,640
September..	473,066	363,505	409,200	95,169	129,475
October	388,777	302,456	452,015	106,582	132,924
November ..	448,716	295,045	434,297	122,290	.....
December ..	357,703	254,676	498,765	134,415	.....
	5,336,494	4,239,837	4,961,815	2,213,042	1,970,000*

*Estimated.

The Outlook

Nineteen twenty-two ends with conditions in iron and steel vastly better than those of one year ago. Nearly all major lines of consumption give promise of a good demand in the months just ahead. Rail orders for 1923 amount to well over 1,500,000 tons, whereas when 1922 opened only 400,000 tons was on the books of the mills. Car builders are carrying over into the new year orders for more than 100,000 freight cars and about 40,000 more are under negotiation. The railroads are already closing first and second quarter contracts for steel car wheels, axles, locomotive tires and forgings. The lack of transportation facilities is still limiting the expansion of business, hence the reasonable expectation of the steel trade that railroad buying will continue to be important, at least for first half of the new year.

The end of house building, which was the source of so much activity last year in lines which are buyers of steel and of certain foundry products, is not yet in sight. It is probable that the 1922 record of $4,300,000,000 in new construction, the largest in the country's history, will not be equaled, seeing that the urgency of demand for new homes, following the holding up of building during the war, is now over. There are signs of advances in building materials, also, that may act as a check.

The automobile makers are planning for heavy production, beginning with February. Their predictions of large output in 1922 were more than borne out, and therefore their favorable estimates for the new year are being received with respect. While the volume of iron and steel business traceable to agricultural demand has often been overestimated, it is something to count on that agricultural machinery companies are enlarging their production programs. The farmer, with the recent considerable increase in cereal values, will now have both the ability and the will to buy.

Unsatisfactory oil prices and the accumulation of the product, while it helped tank construction, was not good for oil well work last year, but for that reason more is expected from the oil fields in 1923 and latterly such demand has increased.

Shipbuilding has been by no means a factor of moment in steel works operation in the past year and a continuance of that condition is to be looked for; but plate mills have such promise of car and tank work that they will not miss the ships.

The building up of stocks of steel by jobbers and

(*Continued on page 65*)

Last Year in Iron and Steel Metallurgy

Review of the Literature and Events in Coal, Pig Iron and Steel Making—Progress in Steels and Alloys—A Forward Look

BY C. E. MAC QUIGG*

C. E. MAC QUIGG

PROGRESS in a special field of technology—while apparently well defined—is often so piecemeal or dovetailed into what has gone before, that it is difficult for the observer to establish arbitrary limits and say: "Thus and so happened in 1922!" Rather must he seek to interpret the trend of events as mirrored in the technical press, noteworthy publications of engineering societies and the "shop talk" of well informed men. As 1921 passed under the onus of commercial depression, the year 1922 has had its burden in the coal and rail strikes. While it is impossible to appraise the setback suffered by technical progress due to such industrial and economic disturbances, nevertheless such influence must be profound and far-reaching. Let us hope that the paralyzing effects on industry may be at least partly offset by the stimulation of inventive ability and a determination more efficiently to utilize our resources.

Coal Beneficiation and Coke

Beneficiation of fuel has received considerable attention, looking toward the elimination of ash, which in turn will make possible the use of coals not economical in their untreated condition.[1] It is likely we are on the eve of a more general practice of concentration of fuel, especially where the beneficiated coal can be used in a finely divided state. There is probably no field today which deserves a greater expenditure of the best engineering thought and research than the field of fuel conservation. "White coal" will not give us our energy requirements and while we can always talk of synthetic fuels derived from rank vegetation, specially grown in the tropics, such luxuries will cost more in money and effort. More power to him who can make one pound of fuel do the work of two!

Increased production in by-product ovens will stimulate their construction by lowering the capital cost per ton of coke produced. This increase may come through the manipulation of oven practice or change in design to make possible the use of so-called non-coking coals or in the shortening of coking times, or in both.

The Roberts[2] recuperator type of by-product oven has operated successfully on the high volatile, high oxygen coals of Illinois and Indiana and made coke, handling these difficult coals in an apparently satisfactory manner. Formerly regarded as non-coking coals, the St. Louis plant has made coke which gave excellent results in the blast furnace, the breeze averaging only 3.7 per cent, which is considered quite good on high volatile coals.

Silica brick recuperators are placed below each oven. The oven is 14 in. in width with a coal capacity of 600 cu. ft. Air for combustion comes up the side walls from counter-current recuperators, meeting the gas at ports at the top where about 50 per cent of the gas is burned in combustion flues. Secondary gas ports admit the remainder of the gas lower down the oven wall and combustion is completed. This has the effect of delaying combustion and is claimed to give a more even heat distribution. With coking times of 12 to 14 hrs., waste gas temperatures are up to 850 deg. Fahr. Gas flues are freed from carbon deposits by admitting air at 1 lb. pressure for a few minutes at intervals, the frequency of which is determined chiefly by the benzol removal. The argument for the counter-current principle of heat is that it makes for uniform oven heating and efficiency in operation. Simplification of reversing gear would seem to make a strong claim for this design.

By new flue designs,[3] the latest Koppers oven cokes perfectly in 11 hr. with a fuel consumption of 1050 B.t.u.'s per lb. of Pittsburgh coal, using for test purposes producer gas with 85 to 125 B.t.u.'s. The new design is for an oven 37 ft. between doors, chamber height 11 ft. 8 in. and average width 14 in. with a pusher taper of 1½ in. Heating is on one side at a time and along its whole length simultaneously, the products of combustion passing across at the top at both the coke and pusher ends—thence to the regenerators through the horizontal flues on the second side. This design is in sharp contrast with that described above, by the absence of counter current flows in adjacent flues. Coke is rapidly made and is claimed to be uniform in character. The claim is also made that oven construction is simplified with increased life and the investment per unit of product has been greatly lowered. In describing the Koppers oven, the reasons for the difference in coking time between American and European practice is discussed. This difference, it is shown, is not due to coal, because English coal imported during the strike was coked in America in record time. The reason given is the differences in refractories and personnel.

In normal by-product oven operation, not more than 50 to 60 per cent, at most, of the gas is available for sale—the balance being used on the ovens. This means that in time of slack demand for coke and where a domestic market is dependent on the gas, a constantly increasing investment accumulates in the shape of stocked coke. It has been found[12] that producer made "blue gas" (water gas without hydro-carbon enrichment), if used to fire the ovens, will make available increased supply of the oven gas for market and help take care of the coke accumulation.

The Blast Furnace

Reese has contributed a notable paper to the British Iron and Steel Institute,[4] discussing iron blast furnace practice. He stresses the importance of a number of factors in design and operation, and lays down specifications for each. While not distinguished for the content of new material, this paper will well repay study by those interested in the blast furnace, since it comes from the pen of an experienced furnace man.

Among the requisites for steady and satisfactory operation are uniformity of coke size. The author

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prefers a uniformity small, rather than large size of coke. Ore should go through a 3 in. or 4 in. ring; this will effect the maximum of "indirect reduction" *i.e.*, high in the stack. Explanation is made of the importance of bell size and slope to furnace behavior with respect to slipping, caused by scaffolding on the walls from improper blast penetration. He rather takes issue with American furnacemen for their discarding the dry blast or failure to exploit it. The explanation of the practical furnace operator in this country—that the efficiencies formerly accruing by use of the dry blast are now obtained by other advances in practice—are not valid since, by dry blast only, are much higher temperatures feasible. Without dry blast he finds it impracticable to run blast temperatures over 1150 to 1250 deg. Fahr. With dry blast the temperatures are 1450 to 1550 or even 1600 deg. Fahr. He discourages blast temperatures below 1400 deg. Fahr. The modern tendencies in large hearth area and a low bosh with a steep angle are also discussed. The low bosh makes for a constantly expanding stack a swelling charge until just below the fusion line. "Effective bosh area" is defined as that portion of the full horizontal bosh area at its maximum diameter, which is in normal activity under the operating conditions of the furnace.

Blast furnace "splits" have received notice because of having caused failures of linings and in some cases even the heavily reinforced shell has not been able to withstand the irresistible expansions. This has apparently been definitely fixed on zinc and zinc oxide accumulations.[11] "Blue Billy" ores, smelted for sulphur, are the worst offenders because of the zinc they carry. One furnace burdened with this ore had the fire brick in the lining partly replaced by zinc and its oxide. While the inwall brick preserved their original shape, on relining, the "brick" could be shoveled out and sold for zinc ore!

Puddling

Announcement has been made of a mechanical puddling mill to be erected at Youngstown, Ohio, using the patented Ford process. Puddle balls weighing 2000 to 2500 lb. will be handled in a plant producing one ton every 20 minutes—this against 2500 to 2700 lb. per day of 5 heats per puddler and one helper. The process is said to have been in successful operation.[7]

In Hibbard's patented furnace for puddling, the molten metal is caused to pour over a dam and mix with the slag through the rotating of the furnace, which is 6 ft. in diameter and 5½ ft. long. A 6-in. magnesite lining is used and the metal is melted in the cupola. The refractories are protected by an initially sintered coating of iron. The furnace capacity is 1200 to 1300 lb. of iron per heat. Metallographic examination is said to indicate no difference in structure between this product and hand puddled wrought iron.[8]

The Bessemer Process

In Europe, interest has been created by the German practice of blowing with pig metal initially much hotter than has been the former practice. Comments on the publication of figures in *Stahl und Eisen* state that it has been for some time the fashion of French metallurgists to run a very hot metal into the Bessemer. Numerous advantages are claimed, particularly the shortening of the long "afterblow." While the idea may have suggestions for adoptation on this side, it must be remembered that European and American Bessemer mill practices are essentially different due to fundamental differences in the nature of the metal charged, hence success on one side will not assure adaptability on the other.

The Open-Hearth Process

A paper presented at the May meeting of the British Iron and Steel Institute is a volume on this subject.[6] While in some of the excellent discussion issue was taken with the figures on thermal efficiency, the work described in the paper constitutes an extremely high order of engineering research work. It is too detailed to be creditably abstracted in the brief space here available. Thermal efficiency by the author was 17 per cent, while, using the same data but a different method, one of the critics obtained 32 per cent. The author made an appeal for English furnacemen more generally to follow the American practice of liberal water cooling.

Comparable in merit and notable for the great amount of experimental work entailed in its preparation, was a paper given in this country on the "Thermal Efficiency and Heat Balance of an Open-Hearth Furnace."[10] Using the methods of the English investigator mentioned above, the paper discusses the effects of changes made in furnace design. Insulation of checkers with the exception of the roof, the latter being too near the failing temperature of the refractories to permit insulation, brings about increase in combustion temperatures. While this in turn does not specifically increase the melting chamber efficiency, there is an advantage to the waste heat boilers. By designing a compromise between the theoretical requirement of a deep checker with restricted horizontal area and small flues on the one hand a lower checker with larger flues to prevent oxide clogging on the other hand, the fuel consumption per ton of ingots has been materially lowered. In 1912 (old type furnace), using a M. R. coal with 8 per cent ash and 11,445 B.t.u., 750 lb. was required per ton of ingots. With improved insulation and attention to the ratio of top opening to sq. ft. of horizontal area, the coal consumption per ton of ingots was cut to 684 lb. using the same coal as above. With a higher B.t.u. coal—13,400—it was possible to get 1 ton of ingots per 548 lb. of coal.

By decreasing port area, better mixture of gases resulted and fuel efficiency was increased. An item of the greatest interest is the final heat balance obtained in this test:

	Per Cent B.t.u. in Coal
Total heat radiated from combustion chamber and port ends	16.6
Gas and air chambers and uptakes	7.3
Gas valve cooling water	2.0
Stock damper cooling water	0.2
Waste gases to boiler	51.0
Net heat to bath	16.1

From the paper, one must include that the open-hearth, per se, is very inefficient and that the utilization of waste heat in the boilers is the saving grace of the process. So much when regarded by itself, but a moment's reflection will show it is not so archaic when compared to many power plant installations.

Ideas involving the use of the blow pipe or Bunsen burner type of combustion on the open-hearth seem to be further advanced in practice. Claims are made for increased production, lower flue temperatures, 20 to 25 per cent fuel economy and longer furnace life. In a word, the principle used is that of mixing the preheated gases in the port and under such velocity as to prevent excessive premature combustion. The flame is directed on to the charge. Additional advantages claimed are possibilities of simplification of design, cheaper construction and allowance of a higher percentage of scrap on the charge.[9] Experience of the merits of the high velocity open-hearth flame has lead one man[10] to state that greater savings are to result from work along this line than in any other, offering opportunity for improvement in the open-hearth process. He suggests such radical changes as would call for possibly a totally inclosed, high pressure furnace, like that exemplified in the iron-blast furnace and using

flames similar to the oxy-acetylene principle and melting from the cold charge to finish in 3 to 4 hours.

Electric Furnaces

Developments in the electric furnace for steel melting have not been lacking. New ideas on the induction furnace have been described. The position of the electric furnace in the steel industry has been decisively stated by Dr. Mathews, an acknowledged authority[19] on the subject. Elimination of the crucible plant by the electric melting furnace seems about as remote as ever. From the tonnage standpoint, however, the electric furnace will naturally make a constantly larger percentage of the fine steels.

Regarded from one angle, the increased use of the electric heat-treating furnace has had to wait on educational propaganda. The reaction in the past towards a suggested installation for electric heat treating has usually been that the outlay would be prohibitive. Upsets in the relative costs of fuels have brought home the fact that the first cost alone and even the fuel cost, will not determine final economy per unit of product. While locality determines fuel cost, important factors must often be sought elsewhere in labor costs, quality of the work and ratio of the accepted to the rejected product. Among the considerations urged for electric treating are uniformity of operation, perfection of control, better furnace conditions, lack of danger of overheating the work and absence of gases and dirt.[20]

Steels and Alloys

During the war a large tonnage of so-called "smokeless steel" was used for the army rifle. This steel called for 0.35 to 0.45 per cent carbon, 1.10 to 1.35 per cent manganese, 0.20 per cent silicon, and low sulphur and phosphorus. A steel varying only slightly from the above has been described before the American Society for Steel Treating, its peculiar adaptability for a forging steel being pointed out.[13]

In a discussion[14] of the physical properties of steel castings it was shown that the metal was *plastic* rather than *elastic*. This is important in connection with the acceptance of material on physical specifications. There are about 10 different names which are more or less loosely (and sometimes inadvisedly) used for what many believe to be the same thing, although in fact quite different, i.e. "yield point," "drop of the beam," "elastic limit," etc. The true limit of elasticity, in some steels at least, seems to be a function of the sensitivity of the methods of measurement.

Due to the necessity of meeting the engineering requirements of chemical processes which are developing along the lines of reactions at higher pressures and temperatures, work has[15] been done on the tensile properties of alloys at high temperatures. The element chromium alone, or its combination with nickel and vanadium in steels, seems to give the most favorable ratio of tensile strength to temperature, especially in the higher temperature ranges.

A study of the resistance of metals to oxidation has been made and some empirical formulae postulated to connect the rate of oxidation with a certain fundamental constant of the given metal. In studying the data,[17] the question occurs, is there a direct relationship between resistance to oxidation at high temperatures and resistance to attack in the wet way, say by acids? The work just mentioned tends to show that resistance to oxidation is dependent on the protective action of the scale formed. A tough adherent and non-permeable scale acts to delay or actually inhibit further attack. That this is true in the case of corrosion in the wet way has also been pointed out.[18]

The problem of corrosion has been actively discussed in England. Sir Robert Hadfield's estimate of the annual loss of metal through corrosion is a staggering figure. This may be combated through more effective protective coatings—a subject which is being investigated there by one of the leading scientific societies—and by the use of alloys like stainless steel or its low carbon counterpart, rustless iron. Interest is lively in these or similar alloys for such special uses as mine cables, where the attack of acid waters may be in the interior strands and proceed undetected. The United States Bureau of Mines has accumulated a vast amount of information on the corrosion of metals and alloys in acid mine waters. It is understood that this question is of increasing importance because of the tendency of the waters to become more acid, with increasing age of the workings.

General Developments

Centrifugal casting of iron[21] and steel[22] by the Hurst and Cammen processes respectively, has been brought to successful practice. In the latter process, the novelty exists in the use of preheated molds by means of which the rate of cooling of the metal is so controlled as to eliminate piping and sponginess in the casting. Aside from claims as to being atractive from the commercial standpoint, the process may open up a new field in the production of seamless tubing out of alloys which are not amenable at present to manufacture by the billet piercing process.

Papers[23] on the manufacture of electrolytic iron from raw sulphide ore direct, indicate that this method may hold great possibilities for the future. Probably as in the case of other processes, notably making of pig iron in the electric furnace, solution of the metallurgical problems has been satisfactory and general use of the process will depend on purely commercial considerations, as cost of electric power and its proximity to ore supplies, market, etc. Combination of water power, or say, gas producer—internal combustion generated electric power—may bring the net fuel cost considerably below present practice. Not the least valuable consideration is that of conservation of iron supply by the utilization of ores not otherwise marketable.

In a discussion before the Faraday Society,[24] some interesting speculations are engaged in as to the probable radical changes in metallurgical practice which would be brought about by the use of an oxygen enriched atmosphere. Revolutionary changes in the design of the iron blast furnace could reasonably be expected. They would be smaller and the stoves would be small or eliminated altogether. Open-hearth furnaces might be modified to the uniflow principle. The basic Bessemer process might be so changed by control of the temperature through oxygen enrichment of the blast as to eliminate the phosphorus before the carbon and thus do away with the necessity of the long afterblow. It is pointed out that these changes might come about through the use of atmospheres up to 40 percent oxygen.

Fatigue testing[25] has advanced in general interest in a way more commensurate with its importance. The Stromeyer method, in which the faint rise in temperature which occurs as the steel passes the endurance limit may be indicated by suitable apparatus and thus lead to a prediction of the endurance limit of the test piece. Results by this method may be obtained in a matter of minutes where formerly the tests to fatigue failure consumed days or weeks. In the A. S. T. M. 1922 symposium, which brought the subject of impact and fatigue testing quite up to date, data were published which makes it appear that possibly the properties of metal are actually improved by repeated alternate stressing just under the fatigue limit. At Watertown arsenal[26] it has been found advisable to reject material for guns which fails to exceed 6 ft. lb. in the Charpy impact test, based on the experience with guns that have failed in service. Failure of the

dynamic tests to correlate with tensile tests may not be taken as indicating their lack of practicability.

Concise coordination of the existing data on the physical properties of metals and their alloys and the changes in these properties which they undergo when subjected to various treatments, is contained in a notable series[26] of articles which has continued to appear during 1922. The subjects discussed are numerous and the treatment so concise that careful study of the text and references will constitute a liberal education in physical metallurgy. Nothing of equal importance on the same subject has appeared since Rosenhain's book.

Interesting speculations have recently been published on the parallelism between the state of carbon or carbide in steel and a colloidal solution[27] and it is ably argued from the results of metallographic examination and behavior towards solution in acid (Eggertz's test), and the characteristics of the resulting solutions, that all of the carbon in a hardened steel is in combination with iron to form an iron carbide and that at least in the case of troosite, this carbide is dispersed in colloidal form. X-ray studies have thrown open a new method of investigation[28] of the crystalline and even the atomic structure of metals and alloys. The extremely short wave lengths permit of diffraction phenomena involving the spacing and structure of the atomic matter itself. This is a very powerful method of research in the physical chemistry of metals and their alloys. The work[29] done by English, Swedish and American investigators has already indicated the vast possibilities along this line. While the study is scarcely a decade old, contributions to our knowledge of crystalline structure have been extremely valuable. The existence of Beta iron has been denied and also the existence of iron carbide in martensite. It is claimed the latter consists of Alpha iron and carbon. A summary of the present views is embodied in the new revised equilibrium diagram[29] which shows the position of Delta iron and eliminates the so-called Beta phase.

The Future in Metallurgy

Questions like those raised by the radical changes in an open-hearth furnace by the suggested use of high-pressure combustion—the use of an oxygen enriched blast in metallurgical processes—winning of metals by direct electrolysis of their ores, etc.—all invite entertaining speculations as to the future chemical processes in metallurgy. Take for example the blast furnace. Beginning with the renowned "Duquesne revolution," the blast furnace has grown larger and larger—hearth diameters have widened and other changes are in proportion. So also with the open-hearth; in fact the tendency is the same in all branches of metallurgy, as exemplified by the Great Falls copper converter. Everywhere change and improvement have been under the impetus of increased unit production. Possibly we have not yet reached the climax as regards size of unit; but are we standing at the threshold of another revolution and if so—what will be its direction and motivating causes? Quoting in part from a late copy of *Science*:

> Our great civilization is "a most squandrous and profligate one and is using the principal of its legacy in numberless new ways." Dr. H. A. Spoehr will declare in the forthcoming issue of the *Journal of Industrial and Engineering Chemistry*. Dr. Spoehr has been working for many years at Carmel, Cal., in the coastal laboratory of the Carnegie Institution of Washington on the question of how plants are able to make use of the energy of the sun's rays, and he has come to the conclusion that the solution of this problem is the task of the twentieth century and demands the cooperative effort of scientists in all fields.
>
> There is as yet no adequate substitute known for the fossil fuel that we have been using so lavishly during the last half century. A year's consumption of coal at the present rate represents the accumulation of hundreds of years. The date of depletion of the petroleum supply of the United States is clearly in sight. Water power would be insufficient, even if we could use every drop that fell in the country for running machinery. Alcohol seems the most promising substitute for mineral oils as a motor fuel, and this can be made in any quantity by the fermentation of various kinds of vegetable matter. But this in any case requires the setting aside of large areas of land for the purpose. If, for instance, corn were to be used for the manufacture of fuel alcohol it would require more than four states the size of Ohio to grow the corn necessary to produce the seven and a half billion gallons of alcohol that would be needed to replace the five billion gallons of gasoline now consumed annually. But we cannot afford to reduce our food to furnish our fuel.

Are we not already at the point where the metallurgist must take as his goal—highest efficiency per unit of fuel?

Signs are not lacking that the present trend in general chemical technology is toward processes at higher temperatures and pressures. One of the present limitations exists in the lack of suitable materials of construction to permit the boosting of the pressure-temperature levels. In supplying these wants the metallurgist and ceramicist will contribute their share to the solution of this vital question of fuel conservation—leaving a fair portion of the work of progress to the mechanical engineer who will devise more efficient recoveries of waste heat.

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The Ferroalloy Industry in 1922

Technical Developments and Market Conditions Reviewed—Effect of the New Import Duties

BY ROBERT J. ANDERSON

R. J. ANDERSON

THE year just brought to a close was one of confusion in the metallurgical, ferroalloy and ore industries, owing to the unsettled condition of the steel trade, the rail and coal strikes, and the metal tariff. Steel ingot output in 1922 was much larger than in 1921, and the production and consumption of the ferroalloys may normally be gaged by the steel production, since the ferroalloy situation ordinarily parallels the steel situation. There is still considerable overcapacity of electric furnace installation for ferroalloy production in the world; some of the plants have been totally shut down, and others have been abandoned, while a few have been diverted to other manufactures. A notable case in point is the change of the works at Anniston, Ala., to phosphoric acid and ferrophosphorus in place of ferromanganese.

The automotive industry operated at a much better rate in 1922 than in 1921, and this was reflected in increased consumption of special alloy steels, and consequently of ferroalloys of some kinds. During the year, producers of ferroalloys in the blast furnace, particularly makers of iron-manganese alloys, had to shut down because of the coal strike and the resultant fuel scarcity coupled with the transportation tie-up. These strikes also caused steel plants to suspend operations with a resultant loss in consumption of ferroalloys, but these difficulties caused strengthening of prices in turn because ferroalloy makers were out of production at the same time. It is of interest to point out that the alloy steel industry continues to increase, and there is a growing demand for electric alloy steel castings, properly heat treated, as a substitute for forgings. Increased use of the special alloy steels is reflected in greater consumption of ferroalloys with accompanying higher prices both for the ferroalloys and their corresponding ores.

Markets, Tariff and Trade

The markets for a number of the ferroalloys and metallurgical ores in 1922 were stagnant and prices were largely nominal, in many instances, in the absence of trading, although most alloys and ores in which considerable business was done showed a downward tendency until the new tariff became effective. In anticipation of the tariff, prices were advanced, and when the bill became effective prices were advanced corresponding to the duties levied and higher. The work of the War Minerals Relief Commission which, as will be recalled, was suspended in 1921, was resumed last year and the hearing of claims was continued.

In the matter of the metal schedule of the tariff, there was much agitation by producers of ferroalloys and metallurgical ores and by users of alloys and the steel trade in general, before the final passage of the Fordney-McCumber bill. The full text of this bill, as applied to metals, alloys and manufactures thereof, was published by THE IRON AGE in the issue of Sept. 21, 1922. In general, the new measure is quite similar to the Payne-Aldrich act so far as rates are concerned, and consequently the duties are considerably higher than those of the Underwood-Simmons tariff. The iron and steel industry is greatly dissatisfied with the rates placed on its raw materials and is strongly opposed to the duties levied on some of the ores and alloys, notably those on manganese ore, ferromanganese and ferrosilicon. The ferroalloys and metallurgical ores were the chief subjects of contention in the preparation of the metal schedule of the new tariff, and this indicates their importance to the steel industry and the general engineering trades. One effect of the new tariff has been that large independent steel makers have been forced into the ferromanganese business and are now making their own iron-manganese alloys from foreign ores.

Metallurgical Developments

So much experimental work has been going on recently in the development of special alloy steels and alloys that it is quite impossible to attempt to deal with this subject at all adequately here. As has been indicated, more alloy steel castings are being made yearly, principally in the electric furnace, for use in place of forgings, and the alloy steel industry has become important in relation to the tonnage output of steel. Further work is being done on the effect of additive elements to cast iron; Guertler, in Germany, has made a comprehensive investigation of the subject, while Moldenke, in the United States, last year studied the effect of nickel-chromium on cast iron with special reference to iron made from the Cuban Mayari ores. In Bulletin 199 of the Bureau of Mines, Gillett and Mack discuss the experimental production of alloy steels; data are given on the recoveries obtained on adding elements in the form of ferroalloys to steel baths. Burgess and Woodward in Technologic Paper No. 207 of the Bureau of Standards discuss the effects of various elements on the properties of steel plates. Both these publications will be found of much interest to steel and ferroalloy metallurgists.

Further attention is being given to the question of preparing low-carbon ferroalloys from the corresponding high-carbon ones, and a number of interesting patents have been taken out, which cannot be cited here. Interest in siliconthermy is active, and the silicon reduction of ores is being applied commercially to an increasing extent. The development of siliconthermy has evidently gone farthest in Germany, and this is discussed below under the caption electric and bessemer ferrosilicons. The further development of cobalt magnet steel is worthy of note, and much work has been done in so-called stainless steels and alloys.

Ferromanganese and Related Alloys

Manganese-ore mining was slack in the United States in 1922 although the output of ore exceeding 35 per cent was greater than in 1921. Imports of high grade ore which came principally from Brazil and

British India were about 410,000 gross tons* in 1922, as compared with 401,354 tons in 1921, and 606,937 tons in 1920. Manganese ore has been going from Russia to Germany in exchange for materials to work mines. The Association of Manganese Ore Miners of the Caucasus has appointed the Iron & Ore Corporation of America as agent for all ores from the Caucasus, but the wretched condition of the Russian railroads and ports, and the chaotic industrial state in Russia preclude any possibility that Russia will soon become an important producer again. The Tennessee Coal, Iron & Railroad Co. acquired a mine in Brazil and is making ferromanganese from Brazilian ores. Imports of manganese ore into England in 1922 were about 207,000 gross tons, as compared with 172,856 tons in 1921, and 452,613 tons in 1920. The new duty on 30 per cent and better manganese ore is $0.01 per lb. on the metallic manganese contained therein. Foreign manganese ore opened the year at $0.23 to $0.24 per unit c.i.f. seaports, with a strengthening tendency during the year, and rose to $0.45 when the tariff became effective.

Output, Imports and Prices

The domestic output of ferromanganese in 1922 was about 145,000 gross tons, as against 98,439 tons in 1921, and 282,681 tons in 1920. The spiegeleisen production in 1922 was about 65,000 gross tons, as contrasted with 56,139 tons in 1921, and 103,448 tons in 1920. The imports of ferromanganese in 1922 were about 90,000 gross tons, as against 9060 tons in 1921, and 59,254 tons in 1920. Exports of ferromanganese in 1922 were about 1500 gross tons as against 684 tons in 1921, and 3454 tons in 1920. Domestic ferromanganese opened at $59 to $63 per gross ton for 76 to 80 per cent, delivered, and the price rose steadily through the year, going to $100, furnace, when the tariff became effective. The duty on ferromanganese is $0.01⅞ per lb., equivalent to $33.60 per ton for 80 per cent alloy. English alloy opened the year at $58 per gross ton, c.i.f. Atlantic ports, and rose to $105, delivered, when the tariff became effective. In the case of spiegeleisen, the 20 per cent alloy opened at $30 per gross ton, and rose to $38-39, delivered, Pittsburgh or Valley points. The 16 to 18 per cent alloy opened at $26 to $30, and rose to $37 at the close.

Owing to the better condition of the steel business in 1922 than in 1921 there was a sharp rebound in production of both spiegeleisen and ferromanganese over the low rates of 1921. Because of the high duty on ferromanganese, more steel companies have taken under advisement the production of the alloy and the effect of the duty will mean greater domestic production —possibly. A stack was blown in by the Jones & Laughlin Steel Co. on ferromanganese at its Woodlawn, Pa., plant. German ferromanganese was offered in the American market at prices less than English or domestic alloys. Experimental work has been carried out on the electrolytic production of alkali permanganates from ferromanganese, and full-size commercial cells have been run.

Electric and Bessemer Ferrosilicons

The situation in ferrosilicon, i.e., the electric furnace grades, has continued to be poor. There is more electric furnace plant installed for making 50 per cent and higher ferrosilicons than is needed, and ferrosilicon is low in price because makers have had to carry out power contracts. Imports of all grades of ferrosilicons in 1922 were about 13,000 gross tons, while exports were about 400 tons. Figures for the domestic production of ferrosilicons are not made public, but the annual requirements of the American steel industry are about 80,000 tons as 50 per cent alloy. About 80,000 tons of blast furnaces grades were made in 1922.

Prices for the various iron-silicon alloys were higher in 1922 than in 1921; they ranged as follows: In the case of Bessemer ferrosilicons the 10, 11, 12, 13, and 14 per cent grades sold respectively at $38.50, $41.80, $45.10, $49.10, and $54.10, at the opening of the year, and rose to $50.50, $53.60, $57.10, $61.10, and $64.10 in September; declines followed. These prices are f.o.b. Jackson and New Straitsville, Ohio. Domestic 12 to 15 per cent electric furnace alloy sold as low as $37; the 50 per cent alloy opened at $54 to $57, freight allowed, and advanced to $82.50 to $87.50 at the close. The 75 per cent grade sold at $115 to $120 per ton during the year. The tariff on ferrosilicons ranges from $0.02 per lb. on silicon alloys containing 8 to 60 per cent Si up to $0.08 for the higher grade alloys.

Thermisilicides

In Germany, a method has been worked out for the preparation of iron-silicon alloys by direct combination of iron and silicon. The method is based upon the fact that when soft iron and silicon are heated together a spontaneous heat reaction takes place at about 1200 deg. C., or considerably below the melting points of either of the metals, and this liquifies the charge yielding an iron silicide. This development was described in THE IRON AGE, Feb. 2, 1922, pp. 337-338. Iron silicon alloys are produced by this process at the Friedrich Krupp Aktien Gesellschaft, and are known in the trade as "thermisilid."

Shelley and others (British patents 184,843, and 184,844) patent the use of silicon or ferrosilicon together with sodium nitrate in place of aluminum in the thermit reduction of ferroalloys. The production of silicon nitride compounds for use in making fertilizers is patented by von Bichowsky (U. S. patent 1,145,280, May 9, 1922).

Ferrochromium and Related Alloys

Chromite mining in the United States continues flat and the industry is dormant. Rhodesia and New Caledonia continue as the leading producers. California concentrates, 50 per cent minimum Cr_2O_3, opened at $22 to $23 per net ton, declined to $19 to $21, and strengthened to $22 to $23 at the close; foreign ore opened at $22 to $23 for 50 per cent minimum, f.o.b. Atlantic seaboard, and declined to $19 to $20 at the close. Chrome ore and chromite are on the free list. Prices for the various grades of ferrochromium were steady all year; the alloy containing 6 to 8 per cent carbon opened at $0.12 per lb. of contained Cr and declined to $0.10 to $0.10½; the 4 to 6 per cent carbon alloy opened at $0.13 and declined to $0.10½ to $0.11 carload lots. The duty on ferrochromium containing 3 per cent carbon or more is $0.03½ per lb., and that on alloys containing less than 3 per cent carbon is 30 per cent *ad valorem*.

Stainless Steel and Iron

The greatest interest and activity continues in stainless steels, so-called, and such materials are being applied for an increasing number of uses. Stainless steel has been employed lately for blades in turbo-generator sets and for rams in hydraulic pumps, and certain grades have been found good for pump parts to resist the action of corrosive acid waters in mines. The Rezistal alloys of C. M. Johnson have been found to be exceptionally resistant to corrosion by acid mine waters. The suit of the American Stainless Steel Co., Pittsburgh, Pa., alleging infringement by the Ludlum Steel Co., Watervliet, N. Y., of the Haynes-Brearley patents, was dismissed on the ground of no infringement. The possible applications of stainless steel in mining have been studied by Hatfield in England, and its use is sug-

* Note that figures for production, imports and exports of ores and alloys in 1922 are estimates in all cases, since they are based on figures for only part of the year.

gested for boiler fittings, pump rods, and pump-cylinder bars; experiments have been carried out on its use for cables, with a view to using these in coal mines. As is well known, in order to produce stainless iron, it is necessary that carbon-free iron and carbon-free chromium or ferrochromium be available, and experiments have been made at the Bureau of Standards on the decarburization of ferrochromium by treatment with hydrogen. The suggestion is made that low-carbon ferrochromium can be prepared by blowing hydrogen through liquid ferrochromium in a Bessemer converter. Moldenke, in a valuable paper has discussed the effect of nickel-chromium on cast iron, referring especially to iron made from the Mayari iron ores of Cuba. This ore has a considerable content of both nickel and chromium, and a marked improvement in the quality of castings is claimed when this iron is used in foundry mixtures.

Ferrotungsten

The tungsten mining industry in the United States has been closed down since 1920, because of the low prices for foreign ores. During the past year prices were exceptionally low, and even with the tariff the domestic mines cannot operate. There is about two years supply of tungsten on hand in the country. Scheelite, 60 per cent WO_3, opened at $2.50 to $2.75 per unit, f.o.b. mines, fell as low as $2 to $2.25 in March, and rose to $8 to $8.25 when the tariff became effective. In the same way, foreign wolframite brought $2.75 to $3, New York, declined to $2 to $2.25, and rose to $8. Chinese ore is selling in London at about $3. As is well known, Hamburg was the tungsten-ore trading center before the war, but New York and London now have become the important markets. The world's consumption of tungsten is at the rate of 15,000 tons per annum.

Imports and Prices

Imports of ore into the United States in 1922 were about 2,000 tons. Five companies and three syndicates operating in the Moina district, Tasmania, have combined and formed one large tungsten company. The duty levied on tungsten ore and concentrates is $0.45 per lb. on the metallic tungsten contained therein. Lubowsky (U. S. patent 1,410,584, March 28, 1922) has patented a process for treating tungsten ores; the ore is roasted with calcium chloride or sodium chloride, and then digested with a mineral acid in order to remove the impurities; ammonia is added, and a separation made, and the ammonia is driven off by heat; calcination at a red heat gives tungsten trioxide.

Ferrotungsten, 70 to 80 per cent grade, sold at $0.40 to $0.45 per pound of contained tungsten last January, declined as low as $0.37, and rose to $0.90 to $0.95. The duty on tungsten, ferrotungsten and related alloys is $0.60 per lb. on the tungsten contained plus 25 per cent *ad valorem*. Foreign competition has stopped the German tungsten industry, and Germany will have difficulty in regaining her place in this field. Vogel has investigated the thermal diagram of equilibrium of the tungsten-nickel system. Tungsten wire sold at $35 to $60 per kg. depending on the gage, and 97 to 98 per cent tungsten powder was $0.45 to $0.60 during the early part of last year, rising to $1.05 per lb.

Ferrovanadium

Ferrovanadium was in ample supply in 1922, although the demand was better than in 1921; still, prices were lower last year. The Vanadium Corporation of America has been operating at its Bridgeville, Pa., plant for the past two years on low grade vanadium-containing slag derived from its earlier operations with the thermit process on Peruvian patronite ores. The slag referred to runs 0.5 to 3 per cent vanadium. Imports of ores from Peru have ceased, and the domestic production of Vanadium concentrates as a by-product of radium has also ceased.

New Process for Producing the Alloy

The Vanadium Corporation has totally abandoned the old thermit process and is using a remarkable electric furnace reduction method worked out by Saklatwalla. This consists in smelting the ore or slag, or a mixture of the two, with coke dust, lime, and fluorspar in an electric furnace. In the furnace, there is a localized zone around the electrodes of extremely high temperature into which the smelting mixture is fed. The process is continuous, and slag and ferrovanadium are tapped off periodically. This electric furnace process makes possible the more complete recovery of the vanadium than the thermit process. The Vanadium Corporation sold the plant of the Primos Chemical Co., its subsidiary.

The African Vanadium & Lead Mines, Ltd., which was floated a few years ago to work deposits in the Zeerust district of Africa is now in liquidation. Vanadium ore, minimum 18 per cent V_2O_5, sold at $1 per lb. of contained V_2O_5 during 1922, while carnotite containing 1.5 per cent U_3O_8 and 5 per cent V_2O_5 brought $1.50 and $0.75 per lb. for each of the oxides; the ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sold at $2.25 and $0.75. Vanadium pentoxide, 99 per cent, sold at $12 to $14 per lb. Ferrovanadium, 30 to 40 per cent V, sold at $4.25 to $4.50 per lb. of contained V at the opening of the year, declined as low as $3 to $3.50, and rose to $3.50 to $4 at the close. The duty on ferrovanadium is 25 per cent *ad valorem*. It is of interest to point out that the Ford Motor Co. has discontinued the use of vanadium steels.

Ferromolybdenum

The mining of molybdenum ores in the United States and all over the world is slack, and prices have been largely nominal. Molybdenite concentrates, 85 per cent MoS_2, opened at $0.45 to $0.50 per lb. of contained MoS_2, New York, and this price prevailed until the tariff became effective when it rose to $0.80 to $0.85. Becket and Holladay (U. S. patent 1,403,477, Jan. 17, 1922) have patented a process for the treatment of molybdenum ores; the ore is leached with a solution of sodium hydroxide or sodium carbonate to extract the molybdenum, leaving the impurities in the residue; the metal is recovered from the solution by precipitation as calcium molybdate and smelting. A process for the production of calcium molybdate from lead molybdate or molydenite has been patented by Kissock (U. S. patent 1,403,035, Jan. 10, 1922).

Work at the Ithaca, N. Y., station of the Bureau of Mines on the use of molybdenum as an alloying element in steel is being continued in co-operation with the Vanadium Corporation of America. Considerable amounts of chrome-molybdenum steels have been employed in automotive construction for rear axle shafts, transmission gears, steering gear knuckles and pins, ring gears and drive pinions. The Ajax Electrothermic Corporation, Trenton, N. J., has sold to the U. S. Molybdenum Metals, Ltd., Los Angeles, Cal., three Ajax Northrup high-frequency induction furnaces with converter equipment; these are to be used at the mines for the reduction of molybdenum and other ores.

Patents and Prices

A number of patents pertaining to molybdenum steels and methods for the preparation of molybdenum and ferromolybdenum have been taken out which can not be cited here, although it is of interest to direct attention to a patent by Sargent and Weitzenkorn (U. S. patent 1,401,924, Dec. 27, 1921) for the reduction of molybdenum. By this patent, a mixture of powdered molybdenite, manganese oxide, and carbon,

with or without iron fillings, is heated to 1,200 deg. Fahr., whereupon a button of substantially pure molybdenum (or ferromolybdenum) forms, containing less than 0.10 per cent sulphur. Mochids (Japanese patent 39,167) has patented a process for the production of molybdenum-aluminum alloys.

Ferromolybdenum sold at $2.25 per lb. of contained Mo, for 50 to 60 per cent alloy, declined to $1.85 to $2 and rose to $2.50 when the tariff became effective. The duty under the new act is $0.50 per lb. on the contained molybdenum plus 15 per cent *ad valorem* for ferromolybdenum, molybdenum metal, calcium molybdate, etc. Molybdenum wire sold at $32 to $40 per lb. for 99.9 per cent metal, and molybdenum powder ranged in price from $2.50 to $5 per lb.

Ferrotitanium, Ferrouranium and Ferrozirconium

Goodwin has run experiments recently in Canada and finds that titaniferous iron ores can be reduced satisfactorily to pig iron in the electric furnace by employing a slag consisting of suitable proportions of titania, silica, and alumina. It is thought that the process is probably applicable to the blast furnace; the method is particularly applicable to titaniferous iron ores high in silica. Nason discussed the titaniferous iron ores of the Adirondacks last year before the American Iron and Steel Institute, indicating that the available tonnage is about 250,000,000 tons. Comstock has investigated the fusibility of open-hearth slag containing titanium dioxide, finding that the presence of a relatively small amount of this constituent in ordinary slag lowers the melting point appreciably. Titanium is discussed by the writer in Serial No. 2406, October, 1922, Monthly Reports of Investigations of the Bureau of Mines; this paper reviews recent developments. Hunter and Bacon have examined the effect of additions of titanium on the magnetic qualities of iron, finding that small additions which simply cleanse the iron improve the magnetic qualities but that larger additions lower the magnetic quality. Titanium pigments are growing in favor, and these are being made in considerable amount both here and in Europe.

Rutile opened the year at $0.15 per lb. for 95 per cent TiO_2 concentrates and declined to $0.12; ilmenite sold at $0.01¼ to $0.01½. Ferrocarbon titanium sold at $200 to $225 per net ton, f.o.b. Niagara Falls, N. Y. The new duty on ferrotitanium is 25 per cent *ad valorem*.

Gillett and Mack in Bulletin 199 of the Bureau of Mines discuss the experimental production of uranium steels; they find that the recovery of uranium is low on adding ordinary ferrouranium to steel baths, and suggest that the best vehicle for introducing uranium into steel is the 40 to 65 per cent ferroalloy with carbon not over 2.5 per cent. MacLean (Canadian patent 220,859, July 11, 1922) has patented an uranium-magnesium-aluminum alloy as a scavenger for use in steel practice. Hess has described the uranium-bearing asphaltites of Utah; and asphaltites carrying vanadium are comparatively well known, but those carrying uranium are not. Deposits in Temple Mountain, Emery county, are being worked by the Chemical Products Co. Uranium oxide, 96 per cent, sold at $2.25 to $2.50 per lb. of contained U_3O_8 last year; quotations for carnotite have been given above under ferrovanadium. Ferrouranium, 35 to 50 per cent, sold at $6 per lb. of contained uranium. The duty on ferrouranium is 25 per cent *ad valorem*.

An important book, "Zirconium and Its Compounds," by F. P. Venable, was published last year; this is the only text on the subject of zirconium. The use of zirconium compounds is increasing, but zirconium has not assumed much importance in the steel industry. Gillett and Mack in Bulletin 199 of the Bureau of Mines indicate that the recovery of zirconium when added to steel in the form of ferrozirconium is low, and that the best recoveries are obtained with zirconium-silicon and nickel-zirconium-silicon. It is also indicated that better recoveries are obtained with low carbon ferrozirconium than with the high carbon alloy. Burgess and Woodward in Technologic Paper, No. 207, of the Bureau of Standards, find that zirconium acts much like titanium and aluminum in steel, i.e., as a scavenger. Washed iron-free zircon sold at $0.04 to $0.13¼ per lb., f.o.b., Pablo, Fla., in 1922. The duty on ferrozirconium is 25 per cent *ad valorem*.

Minor and Complex Ferroalloys

Many developments of an interesting nature are going on in the minor ferroalloys and in special alloys for particular purposes, but the confines of space prohibit dealing adequately with these matters here. Some experiments have been carried out on boron steels but no application has been made. The use of calcium silicide for deoxidizing steel is increasing in favor among English steel makers, although it is not much used in the United States. A French alloy, containing 60 to 65 per cent Si, 30 to 35 per cent Ca, and 2 to 3 per cent Al, is used mostly in England. The Electrometallurgical Co., New York, makes two grades of this alloy; viz., Grade 1, containing 24 to 28 per cent Ca, 65 to 70 per cent Si, 3 to 5 per cent Fe, and about 1 per cent Al; and Grade 2, containing 18 to 22 per cent Ca, 55 to 60 per cent Si, 15 to 20 per cent Fe, and about 1 per cent Al, this latter is really a ferrosilicocalcium.

Considerable interest has been exhibited lately in cobalt for use in making magnet steels. Ordinarily, permanent magnets are made of 5½ per cent tungsten steel, and the substitution of about 15 per cent cobalt for the tungsten raises the coercive force of the steel greatly. These steels are in the experimental stage, and one is being developed by the Cobalt Magnet Steel Co., Ltd., Sheffield, England. Petinot and Turnbull have patented a process for making ferronickel by the electric smelting of an iron-nickel matte with lime and carbon.

Ferrophosphorus from Electric Furnaces

Swann has described the production of ferrophosphorus in the electric furnace, and of phosphoric acid by the condensation and electric precipitation method. Three furnaces are in operation by the Federal Phosphorus Co., Anniston, Ala. Phosphate rock from Tennessee is used largely, and the method consists in charging phosphate rock, coke, sand, and iron borings into an electric furnace, and smelting. The iron absorbs some of the phosphorus, which is tapped from the furnace as ferrophosphorus; this runs about 24 to 25 per cent P. The average sulphur content of this alloy is about 0.009 per cent which is much lower than that of the blast furnace alloy. Ferrophosphorus sells at about $95 per ton for the 20 per cent grade and $120 for the 25 per cent grade. The Fansteel Products Co., Chicago, has developed a process for the production of metallic tantalum, and this metal is now available commercially.

In the case of complex iron alloys, either for steel making purposes or for special uses such as acid-resisting purposes and non-corrosive employment, considerable experimental work has recently been done. The so-called Rezistal alloys developed by C. M. Johnson of the Crucible Steel Co. of America are of much interest. Johnson (U. S. patent 1,420,707, June 27, 1922) has patented an alloy consisting of 10 to 20 per cent Cr, 9 to 25 per cent Ni, 1 to 10 per cent Si, and remainder Fe for making cutlery and machine parts. He has also patented (U. S. patent 1,420,708, June 27, 1922) a high electrical resistance alloy containing 6 to 18 per cent Cr, 12 to 36 per cent Ni, 1 to 10 per cent Si, and Fe 50 per cent or more, the iron being about twice the chromium.

By-Product Coke Capacity 44,000,000 Tons

New Plants Now Building in United States Will Add Nearly 4,000,000 Tons More Annually

AS of Jan. 1, 1923, there was built or building by-product-oven capacity for carbonizing 65,380,200 tons of coal, from which it is calculated there would be a yield of 47,869,000 tons of coke. As of that date, 11,931 ovens were standing or in process of construction. The number under construction, however, was only 403 ovens, including 366, the addition to the Clairton, Pa., plant, Carnegie Steel Co., and 37 ovens for the Weirton Steel Co., Weirton, W. Va. In the past 18 months a total of 253 ovens of different types have been completed and put in operation. This total is made up of 25 Koppers ovens for Alabama By-Products Corporation, Birmingham, Ala.; 30 Koppers ovens for Woodward Iron Co., Woodward, Ala.; 5 Koppers ovens for Chicago By-Product Coke Co., Chicago; 60 Cambria-Belgian and 88 Semet-Solvay ovens at the Rosedale plant, Cambria Steel Co., Johnstown, Pa.; 8 Piette ovens for the Laclede Gas Light Co., St. Louis, and 37 Koppers ovens for the Camden Coke Co., Camden, N. J.

The actual number of ovens in operation today is 11,184, as there are 100 ovens at the Hamilton-Otto Coke Co., Kokotto, Ohio; 24 ovens of the Penn Iron & Coal Co., Canal Dover, Ohio, 100 ovens, Camden Coke Co., Camden, N. J., and 120 ovens of the Alleghany By-Products Coke Co., Glassport, Pa., which are not now in operation, and it will probably be about a year before the addition to the Clairton plant, Carnegie Steel Co., and the new plant of Weirton Steel Co. are in production. Deducting that capacity means that the actual by-product coke ovens standing and in operation are capable of carbonizing 60,846,200 tons with the resultant yield of 44,006,000 tons of coke.

Pennsylvania still holds first place in number of by-product coke ovens and capacity for carbonizing coal. The total number of this type of ovens in Pennsylvania, built or building, is 3520, with a coal carbonizing capacity of 20,040,000 tons, and a coke capacity of 14,785,500 tons.

BY-PRODUCT COKE PLANT CAPACITY IN THE UNITED STATES, JAN. 1, 1923

Owner and Operator	Location	No. of Ovens	Kind of Ovens	Annual Capacity, Net Tons: Coal	Annual Capacity, Net Tons: Coke
		Alabama			
Alabama By-Products Corporation	Birmingham	75	Koppers	502,000	352,000
Gulf States Steel Co.	Alabama City	37	Koppers	237,000	175,000
Tennessee Coal, Iron & Railroad Co.	Ensley	240	Semet-Solvay	760,000	530,000
Sloss-Sheffield Coal & Iron Co.	Birmingham	120	Semet-Solvay	864,000	622,000
Tennessee Coal, Iron & Railroad Co.	Fairfield	434	Koppers	2,560,000	1,920,000
Central Iron & Coal Co.	Holt	60	Semet-Solvay	290,000	220,000
Woodward Iron Co.	Woodward	230	170 Koppers 60 Wilputte	1,000,000 330,000	700,000 231,000
		1,196		6,543,000	4,750,000
		Colorado			
Colorado Fuel & Iron Co.	Minnequa	120	Koppers	720,000	550,000
		Illinois			
Chicago By-Products Coke Co.	Chicago	105	Koppers	722,000	482,000
Coal Products Mfg. Co.	Joliet	53	35 Koppers 18 Wilputte	340,000	238,000
Illinois Steel Co.	Joliet	280	Koppers	1,500,000	1,200,000
International Harvester Co.	South Chicago	88	Wilputte	578,000	376,000
North Shore Gas Co.	Waukegan	13	Semet-Solvay	55,000	38,500
St. Louis Coke & Chem. Co.	Granite City	80	Roberts	400,000	250,000
By-Products Coke Corp.	South Chicago	280	Semet-Solvay	1,300,000	975,000
		899		4,895,000	3,559,500
		Indiana			
Central Indiana Gas Co.	Muncie	22	Klonne	40,000	28,000
Citizens Gas Co.	Langsdale	41	Semet-Solvay	255,000	182,900
Citizens Gas Co.	Prospect	140	100 United-Otto 40 Wilputte	567,000	409,400
Illinois Steel Co.	Gary	700	Koppers	4,400,000	3,480,000
Indiana Gas & Coke Co.	Terre Haute	60	30 Gas Machine 30 Koppers	292,000	205,000
Inland Steel Co.	Indiana Harbor	130	Koppers	890,000	666,000
Linton Gas Co.	Linton	3	Gas Machine	15,000	9,300
Steel & Tube Co.	Indiana Harbor	120	Semet-Solvay	864,000	622,000
		1,216		7,293,000	5,601,700
		Kentucky			
Kentucky Solvay Coke Co.	Ashland	108	Semet-Solvay	864,000	648,000
		Maryland			
Bethlehem Steel Co.	Sparrows Point	360	Koppers	2,190,000	1,576,000
		Massachusetts			
New England Fuel & Trans. Co.	Everett	400	United-Otto	650,000	455,000
		Michigan			
Ford Motor Co.	Dearborn	120	Semet-Solvay	864,000	622,000
Michigan Alkali Co.	Wyandotte	54	United-Otto	169,000	118,400
Semet-Solvay Co.	Detroit	215	Semet-Solvay	1,343,000	1,009,000
		389		2,376,200	1,749,400

Owner and Operator	Location	No. of Ovens	Kind of Ovens	Annual Capacity, Net Tons: Coal	Coke
		Minnesota			
Minnesota By-Products Coke Co.	St. Paul	65	Koppers	400,000	300,000
Minnesota Steel Co.	Duluth	90	Koppers	600,000	450,000
Zenith Furnace Co.	West Duluth	65	United-Otto	160,000	112,000
		220		1,160,000	862,000
		Missouri			
Laclede Gas Light Co.	St. Louis	64	56 Koppers 8 Piette	320,000 40,000	240,000 26,000
				360,000	266,000
		New Jersey			
Camden Coke Co.	Camden	37	Koppers	230,000	164,000
		100	*United-Otto	240,000	168,000
Seaboard By-Products Coke Co.	Kearney	165	Koppers	1,200,000	900,000
		302		1,670,000	1,232,000
		New York			
Donner-Union Coke Corporation	Buffalo	150	Koppers	1,000,000	690,000
Empire Coke Co.	Geneva	46	Semet-Solvay	146,000	102,000
Lackawanna Steel Co.	Lackawanna	530	188 United-Otto 282 Rothberg 60 Semet-Solvay	1,350,000	972,000
Semet-Solvay Process Co.	Syracuse	40	Semet-Solvay	65,000	45,000
Wickwire Spencer Steel Corporation		60	Semet-Solvay	386,000	289,000
		826		2,947,000	2,098,700
		Ohio			
American Steel & Wire Co.	Cleveland	180	Koppers	1,080,000	750,000
Brier Hill Steel Co.	Youngstown	84	Koppers	520,000	379,000
*Hamilton Otto Coke Co.	Kokotto	100	United-Otto	240,000	160,000
McKinney Steel Co.	Cleveland	204	Koppers	1,300,000	910,000
National Tube Co.	Lorain	208	Koppers	1,350,000	945,000
*Penn Iron & Steel Co.	Canal Dover	24	Roberts	144,000	100,000
Republic Iron & Steel Co.	Youngstown	143	Koppers	1,020,000	744,000
Otis Steel Co.	Cleveland	100	Semet-Solvay	450,000	337,500
Ironton Solvay Coke Co.	Ironton	60	Semet-Solvay	432,000	311,000
Portsmouth Solvay Coke Co.	Portsmouth	108	Semet-Solvay	770,000	559,000
Toledo Furnace Co.	Toledo	94	Koppers	560,000	408,800
United Furnace Co.	Canton	47	Koppers	280,000	204,400
Youngstown Sheet & Tube Co.	Youngstown	306	Koppers	2,050,000	1,425,000
		1,658		10,196,000	7,233,700
		Pennsylvania			
*Allegheny By-Products Coke Co.	Glassport	120	United-Otto	260,000	182,000
Bethlehem Steel Co.	Bethlehem	424	Koppers	2,400,000	1,920,000
Bethlehem Steel Co.	Lebanon	90	Semet-Solvay	640,000	465,000
Bethlehem Steel Co.	Steelton	180	120 Semet-Solvay 60 Koppers	876,000	621,000
Cambria Steel Co.	Franklin	492	210 United-Otto 92 Koppers 190 Cambria Belgian	1,829,000	1,226,000
Cambria Steel Co.	Rosedale	208	120 Cambria Belgian 88 Semet-Solvay	1,278,000	895,000
Carnegie Steel Co.	Clairton	366	†Koppers	3,285,000	2,990,000
		768	Koppers	4,800,000	3,360,000
Carnegie Steel Co.	Farrell	212	United-Otto	830,000	531,000
Jones & Laughlin Steel Co.	Pittsburgh	300	Koppers	2,000,000	1,300,000
Philadelphia Suburban Gas & Electric Co.	Chester	40	Semet-Solvay	125,000	87,500
Pittsburgh Crucible Steel Co.	Midland	100	Koppers	667,000	435,000
Rainey Wood Coke Co.	Swedeland	110	Koppers	800,000	600,000
American Manganese Mfg. Co.	Dunbar	110	Semet-Solvay	240,000	173,000
		3,520		20,040,000	14,785,500
		Rhode Island			
Providence Gas Co.	Sassafras Point	40	Koppers	240,000	165,000
		Tennessee			
Chattanooga Gas & Coke Co.	Alton Park	24	Semet-Solvay	175,000	125,000
		Washington			
Seattle Lighting Co.	Seattle	20	Klonne	24,000	18,000
		West Virginia			
Domestic Coke Corporation	Fairmont	60	Koppers	400,000	260,000
LaBelle Iron Works	Follansbee	94	Koppers	610,000	445,000
National Tube Co.	Benwood	120	Semet-Solvay	270,000	189,000
Weirton Steel Co.	Weirton	37	†Koppers	365,000	255,000
		311		1,645,000	1,149,500
		Wisconsin			
Milwaukee Coke & Gas Co.	Milwaukee	150	50 Semet-Solvay 100 Koppers	275,000 667,000	193,000 467,000
Steel & Tube Co. of America	Mayville	108	United-Otto	450,000	384,000
		258		1,392,000	1,044,000

*Not in operation. †Building.

Year of Distress for German Steel Industry

Ruinous Effect of the Mark's Fall and Short Work Day—Production Tends to Lighter Forms and Higher Quality—High Costs Compel Fuel Economies

BY DR. EMIL SCHROEDTER*

THE iron and steel industries in Germany fell in 1922 under the destroying effects of the world war to an incomparably greater degree than in the three years just following the armistice of November, 1918. The memorable words of Andrew Carnegie, "Steel is either a king or a pauper," have proved to be true in the most real way. From a flourishing state in 1914, German iron has sunk in a depression such as never was thought to be possible.

It is not easy to give now an exhaustive review, because the statistical basis is behind for several years and also very incomplete. The Verein Deutscher Eisen und Stahlindustrieller suspended with the end of 1919 its monthly compilation of the production of pig iron and steel in the various districts, and the official statement of the Government comes out with considerable delay; indeed, we are missing these figures as far back as 1920.

In 1913, at the summit of its capacity, the German production in round figures was:

Pig iron	19.3	million metric tons
Steel ingots	19.0	million metric tons
Rolled iron and steel	16.75	million metric tons

The consequence of the war was the loss of 40 per cent of the blast furnaces, 30 per cent of the steel works and almost 30 per cent of the rolling mills. The breakdown of the rest has gone on rapidly from day to day, in the same relation as German money has lost its purchasing value. While in the beginning of the year the dollar was worth 187 marks, the German now (late November) has to pay up to 8000 and 9000 marks for one dollar, as compared with 4 1/5 marks in 1913.

It is evident that in spite of the incessant printing of paper currency (now at the rate of 10 milliards of marks daily, and the Reichsbank had 643.7 milliards in circulation on Nov. 23) and the corresponding depreciation, capital cannot follow, and the opinion is widespread that for only a short time will it be possible to pay the wages, salaries and raw materials for maintaining the labor. The opinion now unanimously held by leading economists of all nations is that the treaty of Versailles and the demands of the reparations committee make impossible a recovery of the general situation, not only in Germany, but also in Europe, and that chaos and bloody revolution in middle Europe will be inevitable if the views expressed a few weeks ago by Mr. McKenna before a meeting of American bankers are not accepted also by the leading political men of all states.

The Situation in Coal

At the outbreak of the war the German production of pit coal stood at third place in the world and at first on the European continent. There had been an increase from year to year, the total going from 96,000,000 tons in 1898 to 191,000,000 tons in 1913, an increase of about 100 per cent. The imports were 11,400,000 tons, the exports 45,400,000 tons and the consumption per year 156,100,000 tons, so that the surplus for export was about 40,000,000 tons. During the war production fell down with the decrease in number of miners, and the further decrease since the war has been due to the shortening of the shift time, the weakened capacity of the men, the depressing effects of foreign control, and to strikes and general troubles.

By the peace-dictate Germany lost the coal mines of Alsace-Lorraine (3,800,000 tons in 1913) and also for 15 years the production of the Saar district, including the Palatinate (13,200,000 tons in 1913), or a total of 9 per cent of the German pre-war production of about 190,000,000 tons. It is understood that the Saar mines are the property of the Prussian Government. After the French occupation the district was put under French custom control, the Prussian officials were exiled and all the industrial works depending on the Saar coal supplies compelled to give up the majority of the shares. Further, Germany lost by the verdict of the "voelkerbund" in the past spring by far the greater part of the coal mines (59 out of 75 pits) and fields in Upper Silesia, in spite of the fact that 64 per cent of the Germans born in this district had given their voice to Germany. The production of this district amounted to 32,700,000 tons in 1913, of which, under the dictate, about 75 per cent fell to Poland, or not far from 17.2 per cent of the German production. The total was therefore 26.15 per cent of the production of 1913.

Pre-War and Later Coal Production

Under these conditions the present German coal production as compared with earlier years is to be considered. The production in the Ruhr district in metric tons was as follows:

	1913	1921	1922	Production per Man and Shift 1913	1921	1922
First 10 months	96,516,019	78,277,610	80,851,760	0.900	0.585	0.592
Whole year	114,550,158	94,114,785	97,000,000*	....	....	....

*Estimated.

The total production in Germany and earlier German districts was, in millions of tons:

	1913 Pit Coal	1913 Brown Coal	1920 Pit Coal	1920 Brown Coal	1921 Pit Coal	1921 Brown Coal	1922 Pit Coal	1922 Brown Coal
Germany, excluding Saar district	173.1	87.2	131.3	93.8	136.1	122.9	138*	145*
Saar and Palatinate	13.2	...	9.2	...	9.5	....	9*	...
Lorraine	3.8	...	2.4	...	3.6	....	...	...

*Estimated.

The manufacturers of coke fell from 32,652,933 tons in 1913 to 27,921,341 tons in 1921, and is now at the rate of 2.40 to 2.57 million tons per month.

Under the pressure of the scarcity of pit coal the production of brown coal or lignite has been augmented considerably, especially in the district on the left of the Rhine near Cologne. The total production there now is at the rate of about 12,000,000 tons per month, or 20 per cent more than in 1921. This fuel has also found good application in the steel works, although its heating effect is only two-ninths that of the pit coal.

Noteworthy and serious from the economical standpoint is the decrease in the capacity of each miner, which fell from 0.90 tons in 1913 to 0.587 tons in October, 1922, per labor day. It is evident that in a time in which after a long war many postponed needs are being expressed, and every one wants to have fuel, the supplies of coal under the present poor conditions

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are quite insufficient; and the more so, as by the decree of Spaa, July, 1920, Germany was forced to deliver to France about 2,000,000 tons of pit coal monthly. This demand has been lessened by the reparations committee to 1,725,000 tons, of which 620,000 tons is to be coke, 100,000 tons coking coal and the rest pit coal. But even this lessened demand is beyond the possibilities.

The dictated supplies now amount to more than 50,000,000 tons. In order to cover the most urgent needs Germany has paid for some months for foreign coal, mostly English, on an average of 8 to 9 milliards of marks, but at the present low value of the mark further imports will be impossible and thus the railroads, electrical, gas and industrial works will be forced to a standstill unless the reparations committee lessens its demands.

The Iron Ore Situation

Before the war the ore consumption of German blast furnaces was covered for more than one-third by imports from Sweden, Spain, France and Greece for iron ores and from the Caucasus, India and Brazil for manganese ores. The home ores were largely minette, from Lorraine and Luxemburg, containing not more than 25 to 32 per cent iron. The 36,000,000 tons home production in 1913 was distributed as follows:

21,100,000	tons minette from Lorraine
7,300,000	tons minette from Luxemburg
3,000,000	tons brown ores from Ilsede, Silesia, Thuringia
2,900,000	tons spathic ores from the Siegerland
1,100,000	tons red ores from Nassau
600,000	tons various ores

In the same year the imports were:

4,500,000	tons from Sweden
3,600,000	tons from Spain
3,900,000	tons from France and Belgium
2,000,000	tons from various countries
14,000,000	tons

A glance at these two tables shows the enormous difficulties of the German blast furnaces in getting ore supplies after the frontiers were closed by the war and after the loss of the minette district later. On the one hand it was impossible to increase in any significant way the production of the home mines; on the other hand the blast furnaces are not able now to pay for ore from abroad on account of the low value of the mark. The unfavorable situation indicated above is confirmed by the statistics. The ores coming from the Prussian mines were in the first quarter of 1922 only

304,827	tons brown ores
482,736	tons spathic ores
221,828	tons hematite ores
1,009,391	tons,

representing a year's rate of about 4,000,000 tons.

The imports to Germany (including Silesia) have been relatively high in the first nine months:

First quarter, 1922	2,244,399 tons
Second quarter, 1922	3,544,472 tons
July	961,767 tons
August	996,961 tons
September	1,089,972 tons

The rich Swedish ores were generally preferred to the poor French minette, owing to the smaller consumption of coke; also because the production of Lorraine, which in 1915 decreased to half of that of 1913, remained down, and finally because railroad freight rates meanwhile have been very high. The scarcity of the home ores has directed the attention of ironmasters on the Rhine to the Wabana ore deposits in Newfoundland, and sales of several million tons were made in the beginning of 1922. Rhenish steel works, Good Hope and Hoerde works contracted on the basis c.i.f. Rotterdam, while Mr. Thyssen bought f.o.b. Newfoundland, as he proposes to ship the material in his own steamers.

Minor qualities of scrap went also to the tops of the furnaces in spite of its high price. (In 1920 about 1,000,000 tons, mostly salvaged war material.)

Blast Furnaces and Steel Works

The loss of iron and steel producing plants suffered by the separation of the provinces in the west and east is shown somewhat in detail in the following brief table:

Blast furnace	From Upper Silesia to Poland	From Upper Silesia to Germany	From Alsace-Lorraine to France	From the Saar District to France
Works	5	3	11	5
Stacks	21	15	64	30
Capacity per year, tons	350,000	250,000	6,200,000	1,500,000
Steel converters	5	8	26	21
Open-hearth furnaces	37	17	9	26
Raw steel capacity, tons	550,000	400,000	2,250,000	2,000,000
Rolling mills	27	4	..	..

By the considerable reductions of the German frontiers, of course all comparisons between the production of old Germany and the Germany of today are illusory. In the following table an effort is made to give for the past ten years the production of pig iron and steel in only those districts now belonging to Germany.

Metric Tons	Pig Iron	Steel Ingots
1913	12,891,000	15,313,000
1914	10,123,000	12,299,000
1915	8,372,000	11,101,000
1916	9,265,000	13,418,000
1917	9,580,000	13,959,000
1918	9,184,000	12,900,000
1919	5,654,000	6,877,000
1920	6,604,000*	9,280,000*
1921	7,620,000*	10,440,000*
1922	8,400,000*	12,000,000*

*Estimated.

Large Use of Scrap for Steel

The at first sight surprising fact that the production of steel has now considerably surpassed that of pig iron finds its explanation in what was said above concerning ore. Scrap of all kinds—home as well as of foreign origin—has assumed great importance in German steel production. While in old Germany the ratio of basic converter steel to open-hearth steel was 10 to 7 in 1913, the latter predominates now to a considerable degree.

Also, steel melted in the electric furnace increased from 89,000 tons in 1914 to 240,000 tons in 1918, and at least 300,000 tons in 1922. There are now about 30 steel works in Germany making crucible, tool and similar steel. *In general it may be said that the growing difficulties in the supplies of ores and coal have forced the works to stop the rolling of heavy products, as rails, girders, etc., and to make more manufactured products of lighter weights and higher qualities.*

Coal Control

The prices of coal and iron in Germany are no more matter for free negotiation between producer and consumer, but they are regulated by organizations under the control of the Government. The coal producers are united in a joint stock company, the Reichskohlenverband, the function of which is to regulate the distribution of the coal, the survey of the exports and the fixing of the prices. But all their decisions are dependent on the sanction of the Reichskohlenrat, a mixed committee of delegates of the coal mines, the consumers and the Government, which has also the veto right. The work done by the combined organization finds expression in the following table:

	Number of Price Increases	Increase Within the Year, Marks
1919	6	from 43.10 to 88.70
1920	5	from 88.70 to 198.70
1921	4	from 198.70 to 405.10
1922 (10 months)	13	from 405.10 to 8,143
Nov. 15		19,543

The above prices are given for a gas coal of good average quality. The price of coke, which was at 16 marks in 1913, is now at 20,487 marks. The increases were caused by the rising costs of materials and wages. On April 1 the public taxes were increased from 20 to 40 per cent (Kohlensteur).

Iron and Steel Price Regulation

The corresponding organizations for the regulation of the prices of iron and steel are the Eisenwirthschaftsbund, a so-called self-governing body composed of representatives of the producers, merchants and consumers, as well as of iron masters and laborers, and the

Table I—Iron and Steel Prices in Marks per 1000 Kg.

	Hematite	Foundry No. 1	Spiegel 8-10% Mn.	Basic Bessemer Ingots	Open-Hearth Ingots	Steel Billets	Steel Bars	Sheets 5 mm. and Thicker
Dec. 1, 1921 } Jan. 1, 1922 }	3,891	3,326	3,067	3,830	4,130	4,230	5,030	5,630
Feb. 1, 1922..	3,979	3,447	3,186	4,210	4,510	4,680	5,550	6,220
March 1.....	4,744	4,212	3,951	5,320	5,820	5,945	7,050	7,805
April 1.....	6,264	5,549	6,020	7,380	8,280	8,270	9,810	11,000
May 1.....	6,435	5,870	6,825	7,960	8,860	8,965	10,640	11,930
June 1.....	6,724	6,206	7,137	7,960	8,860	8,965	10,640	11,930
July 1.....	8,265	7,915	8,929	8,520	9,420	9,660	11,470	12,° 0
Aug. 1.....	11,317	10,481	11,823	14,481	15,380	16,420	19,470	21,860
Aug. 11.....	13,267	11,784	13,561	15,670	16,640	17,770	21,070	23,660
Aug. 21.....	16,548	13,637	16,561	17,880	18,850	20,280	24,050	27,000
Sept. 1.....	29,784	25,575	30,133	32,330	34,350	37,190	44,150	49,620
Sept. 11.....	29,722	26,242	31,433	34,370	36,390	39,530	46,930	52,750
Sept. 21.....	30,506	26,524	31,433	34,370	36,390	39,530	46,930	52,750
Oct. 1.....	30,544	27,413	32,483	36,130	38,960	41,715	49,545	55,695
Oct. 11.....	38,099	32,696	34,494	57,640	60,470	66,290	78,700	88,460
Oct. 18.....	39,921	35,173	36,579	59,470	62,300	68,400	81,200	91,270
Oct. 25.....	48,862	40,176	36,579	71,960	74,790	82,760	98,270	110,440
Nov. 1.....	48,862	40,176	36,579	96,700	99,530	111,200	132,000	148,300
Nov. 8.....	83,994	73,662	77,356	112,800	115,630	129,700	154,000	173,000
Nov. 14.....	95,243	79,243	77,356	150,700	162,800	175,100	203,000	229,000
Nov. 15.....	143,365	110,173	110,994	161,600	173,700	188,700	219,200	247,300
Nov. 27.....	130,829	107,765	110,994	161,600	181,800	213,000	244,200	276,300

Stahlbund, which was organized after the collapse of the old Stahlwerksverband, caused by the loss of Lorraine and Silesia, and which practically comprise all German steel works, rolling mills and iron foundries. The Eisenwirthschaftsbund was organized by the State authority against the opposition of the iron masters in order to fulfill the urgent demands of the consumers, who wished to cover their supplies at cheaper prices than their foreign competitors. The prices of pig iron, which is sold by the Roheisenverband in Essen, are still regulated by a special committee of the Eisenwirthschaftsbund, while its further activity has satisfied no one and it ceased from April, 1921, to fix maximum prices. The prices for steel products are now regulated by the Stahlbund, a so-called "Richt-preise," corresponding to the coal and ore prices, the wages and costs of materials, taxes, etc. As the blast furnaces have to import about 80 per cent of their ores, the international value of the mark plays, of course, a decisive rôle. The sales are contracted directly between the producers and the consumers or dealers, but under appointed conditions, either at a sliding scale or at fixed prices, according to the free will of the contractors. Under these agreements the prices have been altered for pig iron in 19 and for steel products in 15 cases in the course of the year 1922 up to the present time. The tragic significance of their course is shown in Table I.

Eight-Hour Day a Handicap

The average working time was 10 hr. until November, 1918; in continuous work, as blast furnaces, steel works and rolling mills, there was a change of men twice in 24 hr. In order to facilitate the demobilization of the troops returning from the war, there was fixed a general working day of not more than 8 hr. The iron and steel works thus were forced to introduce a third shift per day and to engage 50 per cent more men. The miners reduced their shift time to 7 hr. The number of men occupied in the Ruhr coal mining increased from 409,182 in 1913 to 556,808 in 1922, and the quantity of coal produced per head fell from 900 to 590 kg. per day. The definite legalization of the working time is now in preparation. The laborers and their unions are not willing to make any concessions, while the employers declare that a state which has lost a long war cannot sustain life with a working time two hours less than before the war.

In an open letter, the well-known iron master, August Thyssen, who in June of this year celebrated his 80th birthday, addressed in October to Reichskanzler Wirth a strong call to take the leadership in the reintroduction of a prolonged working time. He finds the principal cause of the present calamity in Germany in the impossible conditions of the dictated peace of Versailles, but considers his countrymen also a good deal at fault. The most serious threat of revolution, he says, is to be found in the general introduction of the 8-hr. labor day with its very considerable reduction in output. A people cannot consume more than it produces; that means living off capital. And this is going on now to a terrible degree in Germany. The inevitable consequence must be total ruin. In Mr. Thyssen's opinion the only possible escape is a return to the old working hours. This appeal has found a strong echo in circles in which there are clear thinking and broad views on economic problems.

Exports and Imports

The foreign trade balance for 1922 is very unfavorable. Owing to the unreliable and irritating figures which have been published previously, the Government resolved to publish provisionally only the quantities of the imports and exports, and to put the values which had been given before in paper marks on the basis of the gold mark, in order to avoid the great errors originating from the fluctuations of the paper mark. A rough estimate is that in the first nine months of 1922 the value of the imports was 2,900,000,000 gold marks against 4,500,000,000 marks for exports, so that there is a deficit of over 1,500,000,000 marks. The surplus of imports over exports was 364,000,000 gold marks in July, 303,000,000 in August and 141,000,000 in September. The quantities in the first eight months of 1922 as compared with 1913, were as follows in metric tons:

	Imports		Exports	
	1913	1922	1913	1922
Iron ores.....	9,444,744	7,060,238	1,786,179	81,477
Pit coal.....	6,964,395	5,365,611	22,473,309	4,564,940
Coke.....	409,956	131,647	4,502,886	680,499
Machinery.....	67,790	7,151	371,521	308,145

The movement in manufactured iron and steel is indicated in the following table, in metric tons:

	Eight Months—January to August			
	Imports		Exports	
	1913	1922	1913	1922
Scrap	154,869	381,856	132,869	27,719
Pig iron	77,694	173,042	572,567	105,749
Blooms and billets.....	6,363	171,409	427,934	37,382
Rails and rail material	862	72,050	509,485	279,557
Girders	504	97,419	332,005	25,132
Steel bars	16,653	348,703	740,802	305,528
Plates over 5 mm.....	384	24,998	299,324	102,179
Sheets	10,509	18,310	91,288	50,216
Tin plate	28,264	9,449	481	4,041
Iron and steel wire....	7,617	30,822	183,685	63,337
Tubes of all kinds.....	5,109	6,525	188,894	86,215
Forgings	6,873	3,014	61,728	15,990
Cast iron	14,565	36,898	139,956	97,986
Hardware	21,155	12,295	301,697	317,443
Total	424,891	1,424,483	4,298,165	1,645,104

Fabulous Mark Figures

While the working time has been shortened, wages and salaries have increased by leaps and bounds. They followed, of course, the pitiful devalorization of the paper mark. While an American dollar was worth 4.1875 marks on June 15, 1914, the German had to pay at the beginning of 1922 about 180 marks; on July 1,

(*Concluded on page* 79)

Iron and Steel Prices for Twenty-One Years

Monthly Averages Computed from the Weekly Market Quotations of THE IRON AGE in the Period of 1902 to 1922

IN this issue of THE IRON AGE are our three charts, in two of which lines are plotted to indicate the course of prices for pig iron, billets and leading forms of finished iron and steel and non-ferrous metals in the quarter century ended with 1922. The other chart covers 18 years, beginning with 1905. The diagrams are based on monthly averages of prices quoted week by week in our market reports from the leading selling centers. In the tables following are the monthly average prices of 48 products, including those on which the charts are based.

Bessemer Pig Iron at Pittsburgh, Dollars per Gross Ton (2240 lb.)

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$16.70	$22.15	$13.91	$16.85	$18.35	$23.15	$19.00	$17.34	$19.90	$15.90	$15.05	$18.15	$14.96	$14.59	$21.58	$35.95	$37.25	$33.60	$40.00	$33.96	$21.56
February	16.93	21.45	13.66	16.41	18.35	22.85	17.90	16.78	19.34	15.90	14.90	18.15	15.09	14.55	21.51	35.95	37.25	33.60	42.90	31.46	21.46
March	17.37	21.85	14.25	16.35	18.28	22.85	17.86	16.25	18.60	15.90	15.09	18.15	15.09	14.55	21.75	37.70	37.25	32.54	43.40	28.16	21.46
April	18.75	21.28	14.18	16.35	18.19	23.35	17.49	15.78	18.27	15.90	15.15	17.90	14.90	14.55	21.95	42.20	36.15	29.35	43.60	26.96	22.59
May	20.75	20.01	13.60	16.16	18.10	24.01	16.93	15.84	17.52	15.90	15.13	17.70	14.90	14.59	21.95	45.15	36.15	29.35	44.03	26.16	26.36
June	21.56	19.72	12.81	16.65	18.23	24.27	16.90	16.05	16.60	15.90	15.15	17.14	14.90	14.70	21.95	54.70	36.38	29.35	44.80	24.71	26.96
July	21.60	18.89	12.40	14.85	18.41	23.55	16.83	16.46	16.40	15.90	15.20	16.70	14.90	14.95	21.95	57.45	36.60	29.35	47.15	22.84	26.77
August	21.63	18.35	12.81	15.20	19.00	22.90	16.23	17.03	16.09	15.90	15.46	16.52	14.90	15.95	21.95	54.75	36.60	29.35	49.11	21.96	29.96
September	21.75	17.23	12.63	15.91	19.54	22.90	15.90	18.05	15.50	15.90	16.15	16.65	14.90	16.85	22.36	48.03	36.60	29.35	50.46	21.96	35.27
October	21.75	16.05	13.10	16.54	20.35	22.00	15.71	19.53	15.90	15.44	17.80	16.60	14.84	16.95	24.08	37.25	36.60	29.35	49.16	21.96	35.17
November	21.68	15.18	14.85	17.85	22.85	20.65	16.59	19.90	15.82	15.00	18.02	16.02	14.59	17.51	30.15	37.25	36.60	31.26	41.10	21.96	33.52
December	21.75	14.40	16.65	18.35	23.75	19.34	17.40	19.90	15.90	15.03	18.15	15.77	14.70	19.65	35.68	37.25	36.60	36.65	36.96	21.96	29.90
Average	*20.18*	*18.88*	*13.74*	*16.46*	*19.45*	*22.65*	*17.06*	*17.41*	*17.19*	*15.71*	*15.94*	*17.12*	*14.89*	*15.78*	*23.90*	*43.64*	*36.67*	*31.09*	*44.39*	*25.34*	*27.58*

Basic Pig Iron, f.o.b. Mahoning or Shenango Valley Furnace, Dollars per Gross Ton

January	.....	.....	.....	$15.46	$17.06	$21.90	$16.90	$15.50	$16.87	$13.25	$12.35	$16.41	$12.50	$12.50	$17.81	$30.00	$33.00	$30.00	$37.40	$30.00	$18.15
February	.....	.....	.....	15.25	16.82	22.00	15.97	15.12	16.31	13.65	12.25	16.30	13.19	12.50	17.69	30.00	33.00	30.00	42.25	27.50	17.75
March	.....	.....	.....	15.55	16.85	21.50	15.62	14.94	16.00	13.75	12.81	16.11	13.00	12.50	18.20	32.25	33.00	28.94	41.50	24.20	17.94
April	.....	.....	.....	15.06	16.88	21.50	15.25	14.05	15.94	13.75	13.00	15.87	13.00	12.50	18.13	38.75	32.00	25.75	42.40	22.88	20.00
May	.....	.....	.....	15.06	17.00	22.90	14.91	14.12	15.19	13.32	13.00	15.15	13.00	12.50	18.00	41.60	32.00	25.75	43.25	22.00	24.60
June	.....	.....	$11.76	14.60	16.94	22.40	15.25	14.62	14.70	13.05	13.12	14.50	13.00	12.59	18.00	48.75	32.00	25.75	44.00	20.75	25.00
July	.....	.....	11.20	14.00	17.12	21.75	14.51	15.05	14.50	13.12	13.40	14.37	13.00	12.74	18.00	52.50	32.00	25.75	45.85	19.38	24.25
August	.....	.....	11.69	14.32	17.70	21.25	14.69	15.25	14.12	13.00	13.94	14.06	13.00	14.06	18.00	51.20	32.00	25.75	48.10	18.20	26.60
September	.....	.....	11.60	14.86	18.44	20.06	14.43	15.90	13.70	12.80	14.37	14.00	13.00	14.75	18.31	42.75	32.00	25.75	48.50	19.13	32.63
October	.....	.....	12.19	15.25	19.55	19.50	14.04	16.94	13.15	12.52	15.98	13.90	12.81	15.00	19.88	33.00	33.00	25.75	43.75	19.19	30.90
November	.....	.....	14.00	16.87	21.37	18.12	14.72	17.25	13.25	12.42	16.37	13.09	12.48	15.75	25.10	33.00	33.00	28.31	36.50	19.00	27.75
December	.....	.....	15.70	16.75	21.50	17.50	15.60	17.05	13.40	12.25	16.50	12.71	12.50	17.50	30.00	33.00	33.00	34.25	33.00	18.63	24.81
Average	.....	.....	*13.59*	*15.85*	*18.10*	*20.87*	*15.16*	*15.48*	*14.76*	*13.07*	*13.98*	*14.71*	*13.87*	*13.74*	*19.76*	*38.90*	*32.50*	*27.66*	*43.21*	*21.74*	*24.20*

Southern No. 2 Foundry Pig Iron at Cincinnati, Dollars per Gross Ton

January	$14.55	$21.65	$12.37	$16.25	$16.75	$26.00	$16.15	$16.25	$17.25	$14.25	$13.25	$16.95	$13.88	$12.40	$17.90	$26.10	$35.90	$34.60	$41.80	$36.75	$20.70
February	14.75	21.50	12.12	16.25	16.75	26.00	15.75	16.13	17.06	14.25	13.31	16.69	13.81	12.40	17.90	27.53	35.90	34.60	43.60	32.63	20.00
March	14.75	21.37	12.10	16.25	16.65	26.00	15.50	15.05	16.30	14.25	13.50	16.31	14.00	12.27	17.90	31.90	35.90	33.54	43.60	29.80	19.50
April	16.87	20.15	12.50	16.25	16.63	25.06	15.20	14.25	15.37	14.25	13.75	15.65	13.75	12.34	17.90	37.40	35.90	30.35	44.00	28.00	20.38
May	18.35	18.87	12.25	15.81	16.75	24.25	14.75	14.50	15.00	13.95	14.15	14.94	13.75	12.40	17.90	41.90	35.90	29.85	45.60	26.70	22.10
June	20.19	17.75	11.80	14.65	16.44	24.10	15.25	14.70	14.85	13.44	14.25	14.06	13.63	12.50	17.34	45.15	36.08	28.39	45.60	26.38	23.00
July	20.75	16.15	11.81	13.94	16.06	23.85	15.00	15.75	14.75	13.25	14.70	13.75	13.30	12.71	16.90	49.90	36.60	28.35	45.60	24.75	22.30
August	23.06	15.19	12.00	14.40	17.30	23.00	15.25	16.38	14.31	13.45	15.06	14.06	13.25	13.71	16.70	49.90	36.60	30.40	45.78	23.50	24.35
September	25.00	14.75	12.00	14.37	18.69	21.50	15.65	17.35	14.25	13.31	15.87	14.25	13.25	14.15	17.28	49.90	36.60	31.25	46.50	23.50	29.55
October	25.65	13.50	12.81	15.31	20.00	20.95	15.75	17.88	14.25	13.25	16.80	14.35	12.90	14.78	18.03	49.38	37.60	31.60	46.50	23.50	30.85
November	23.62	12.00	15.19	16.60	23.38	19.50	16.00	17.75	14.25	13.20	17.25	13.87	12.90	16.15	22.40	35.90	37.60	34.35	42.50	22.90	27.55
December	22.44	12.05	15.85	16.75	25.00	17.00	16.25	17.45	14.25	13.19	17.25	13.95	12.50	17.10	25.90	35.90	37.60	38.60	42.50	21.75	26.93
Average	*20.00*	*17.08*	*13.73*	*15.57*	*18.37*	*23.10*	*15.84*	*16.18*	*15.16*	*13.67*	*14.93*	*14.90*	*13.41*	*13.68*	*18.67*	*40.07*	*36.58*	*32.16*	*44.47*	*25.68*	*23.95*

Local No. 2 Foundry Pig Iron at Chicago (at Furnace), Dollars per Gross Ton

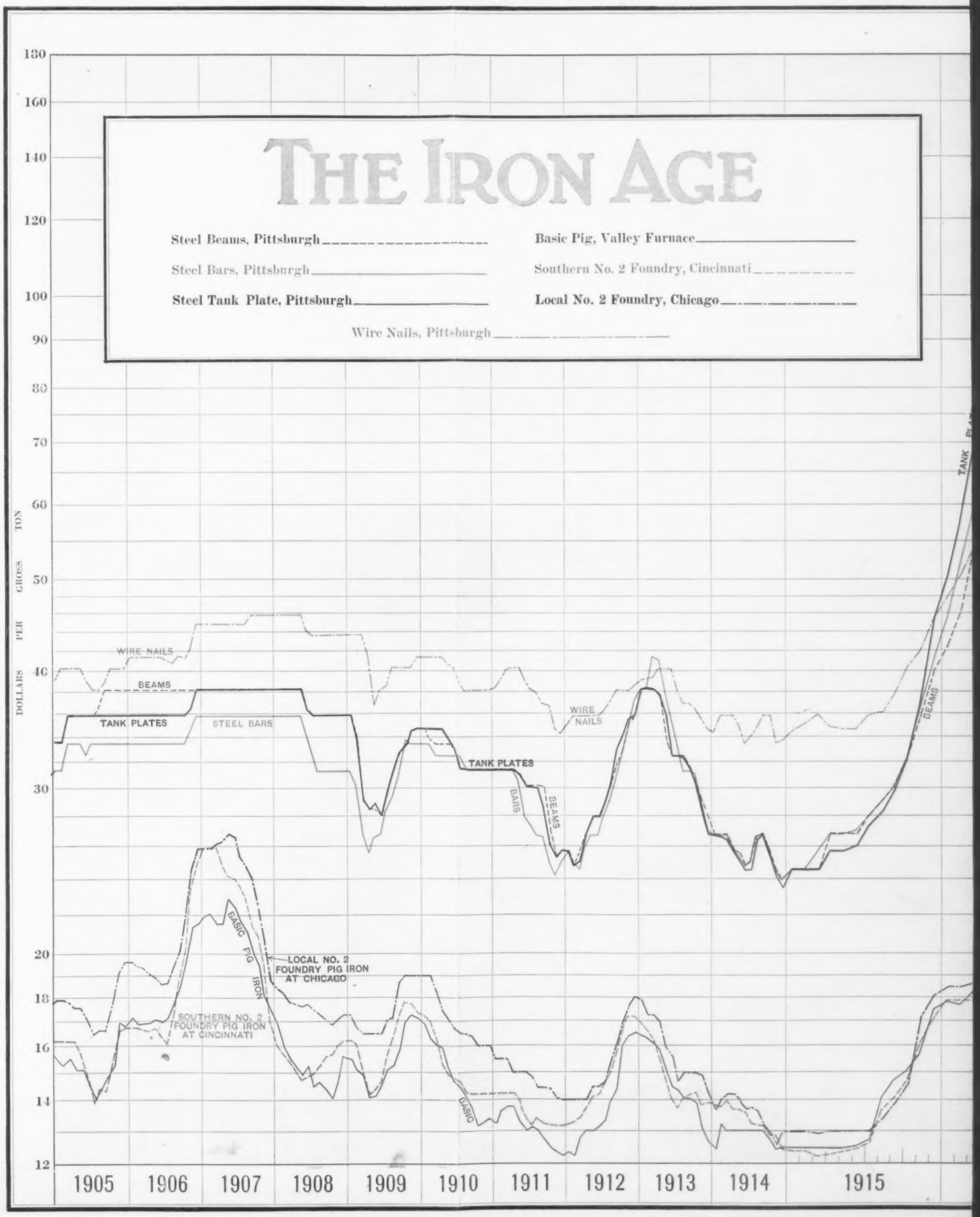
January	$16.25	$23.45	$14.47	$17.85	$19.60	$25.85	$18.45	$17.35	$19.00	$15.50	$14.00	$17.90	$13.75	$13.00	$18.50	$30.00	$33.00	$31.00	$40.00	$31.50	$18.90
February	16.85	23.35	13.91	17.85	19.41	25.85	18.16	16.75	19.00	15.50	14.00	17.31	14.00	13.00	18.50	32.00	33.00	31.00	42.25	29.00	19.00
March	18.51	23.22	14.05	17.80	19.35	26.10	17.85	16.50	18.30	15.50	14.00	17.25	14.25	12.95	18.70	36.00	33.00	29.94	43.00	25.60	20.00
April	18.97	22.87	14.35	17.60	19.10	26.35	17.73	16.50	17.50	15.00	14.00	17.00	14.25	13.00	19.00	39.25	33.00	26.75	43.00	24.00	20.50
May	20.85	20.72	13.85	17.60	18.90	26.85	17.63	16.50	17.06	15.00	14.50	16.00	14.06	13.00	19.00	43.80	33.00	26.75	43.00	22.80	22.60
June	21.85	19.85	13.70	17.00	18.54	26.60	17.73	16.50	16.75	15.00	14.50	15.62	13.69	13.00	19.00	51.00	33.00	26.75	43.40	20.75	23.25
July	21.60	18.25	13.60	16.47	18.60	25.55	17.55	17.00	16.56	14.87	14.70	14.70	13.75	13.00	19.00	55.00	33.00	26.75	45.25	19.00	24.25
August	22.10	17.22	13.60	16.60	19.45	24.85	17.35	17.13	16.50	14.50	15.37	15.00	13.69	13.44	18.40	55.00	33.00	26.75	46.00	19.55	28.60
September	23.35	16.41	13.85	16.60	20.16	24.10	17.05	18.70	16.40	14.50	16.00	15.00	13.25	13.90	18.13	54.67	33.00	26.75	46.00	21.75	32.00
October	23.35	15.70	14.10	17.66	21.48	22.45	16.85	19.00	16.00	14.46	17.00	15.00	12.94	14.63	19.63	33.00	34.00	27.75	44.50	21.00	31.40
November	23.35	15.10	15.98	19.15	24.70	20.66	17.10	19.00	16.00	14.09	17.75	14.87	12.56	17.13	25.80	33.00	34.00	31.00	39.40	20.60	29.75
December	23.35	14.81	16.95	19.60	25.85	18.80	17.35	19.00	16.00	14.00	18.00	14.30	13.00	18.10	29.50	33.00	34.00	38.75	34.50	19.63	28.00
Average	*20.87*	*19.25*	*14.37*	*17.65*	*20.43*	*24.50*	*17.67*	*17.49*	*17.09*	*14.83*	*15.38*	*15.83*	*13.60*	*14.01*	*20.26*	*41.31*	*33.25*	*29.16*	*43.53*	*22.93*	*24.85*

Standard Brands Eastern Pennsylvania No. 2X Foundry Pig Iron at Philadelphia, Dollars per Gross Ton

January	$16.75	$22.45	$14.69	$17.50	$18.50	$24.80	$18.25	$17.25	$19.00	$15.50	$14.85	$18.25	$14.65	$14.25	$19.94	$30.10	$34.25	$36.15	$44.10	$33.34	$21.34
February	17.19	22.25	14.50	17.50	18.50	25.87	18.25	17.00	18.69	15.50	14.85	18.25	14.94	14.25	20.00	31.88	34.25	36.15	45.10	31.09	21.09
March	18.81	22.25	14.80	17.56	18.35	25.00	18.12	16.37	18.00	15.50	14.92	17.77	15.00	14.25	20.05	37.31	34.25	34.39	45.53	27.59	21.26
April	19.62	21.87	15.00	17.75	18.44	24.81	17.65	16.20	17.75	15.50	15.00	17.40	15.00	14.25	20.50	41.38	34.25	31.90	46.85	26.26	23.62
May	19.75	20.06	14.75	17.81	18.50	25.55	16.94	16.06	17.00	15.50	15.18	16.75	14.81	14.25	20.50	43.60	34.25	30.70	47.10	25.71	26.09
June	20.94	19.19	14.50	16.75	18.44	24.62	16.62	16.42	16.55	15.25	15.31	16.19	14.75	14.25	19.94	48.19	34.29	29.50	47.15	25.50	27.06
July	22.30	18.10	14.31	16.12	18.25	23.06	16.50	16.50	16.25	15.00	15.70	15.60	14.75	14.31	19.75	53.13	34.40	29.06	48.15	23.55	27.92
August	22.00	16.87	14.25	16.25	19.00	21.90	16.50	17.00	16.00	15.00	15.87	15.60	14.75	14.94	19.55	53.00	34.40	29.60	51.96	20.64	32.26
September	22.00	16.12	14.25	16.43	20.44	20.50	16.62	18.06	16.00	15.00	16.59	15.83	14.75	16.00	19.50	51.67	34.40	30.70	53.61	21.23	34.83
October	22.12	15.20	14.43	17.25	21.12	19.85	16.75	18.69	15.81	15.00	17.60	15.96	14.63	16.25	20.31	34.25	38.85	33.10	52.83	22.23	32.54
November	23.37	15.00	15.75	18.05	23.30	18.94	17.00	19.00	15.68	14.95	18.25	15.56	14.50	17.12	24.90	34.25	39.15	35.35	44.99	22.74	30.39
December	23.00	15.00	16.90	18.25	24.00	18.84	17.25	19.00	15.50	14.85	18.25	15.20	14.25	19.05	29.25	34.25	39.15	40.10	35.54	21.82	28.86
Average	*20.05*	*18.70*	*14.84*	*17.27*	*19.74*	*23.81*	*17.20*	*17.30*	*16.85*	*15.21*	*16.03*	*16.53*	*14.73*	*15.98*	*21.18*	*41.06*	*36.49*	*32.98*	*46.83*	*25.14*	*27.27*

Mahoning and Shenango Valley No. 2 Foundry Iron, at Furnace, Dollars per Gross Ton

	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$22.30	$13.00	$16.12	$17.31	$24.60	$16.80	$15.44	$17.00	$13.75	$13.00	$17.50	$12.85	$13.00	$18.50	$31.00	$33.00	$31.00	$39.40	$31.88	$19.30
February	21.95	12.47	16.00	17.25	24.12	16.00	15.06	16.69	13.75	13.00	17.00	13.19	13.00	18.31	32.00	33.00	31.00	41.50	25.00	18.88
March	22.00	12.91	16.00	17.12	24.00	15.56	14.50	16.10	13.75	13.12	16.69	13.25	13.00	18.50	34.75	33.00	29.94	41.25	25.90	19.00
April	20.99	13.01	16.00	16.50	24.00	15.15	14.00	15.62	13.75	13.25	15.55	13.25	12.75	18.50	39.75	33.00	26.75	42.80	24.75	20.75
May	20.32	12.47	15.55	16.30	25.00	14.87	14.19	15.31	13.75	13.25	14.62	13.00	12.94	18.20	42.40	33.00	26.75	44.25	23.50	23.80
June	19.37	11.96	14.81	16.19	25.12	15.00	14.90	14.75	13.56	13.25	14.06	13.00	12.69	18.13	50.25	33.00	26.75	45.00	22.10	24.00
July	18.02	11.67	14.25	16.44	22.80	14.80	15.19	14.31	13.50	13.37	13.87	13.00	12.70	18.25	54.50	33.00	26.75	45.00	20.13	24.25
August	16.34	11.87	14.15	17.71	22.50	14.50	15.31	14.15	13.50	13.69	14.00	13.00	13.62	18.25	53.20	33.00	26.75	47.00	19.63	32.60
September	14.98	11.71	14.56	19.56	20.87	14.47	15.75	13.75	13.44	14.44	14.00	13.00	14.70	18.39	47.00	33.00	26.75	49.40	21.00	24.88
October	14.09	12.50	15.50	21.35	19.80	14.36	17.12	13.94	13.37	16.10	13.84	12.90	14.87	20.00	33.00	34.00	26.75	46.50	21.00	31.80
November	13.32	14.60	16.83	23.87	19.00	15.25	17.25	13.90	13.20	16.94	13.50	12.75	15.50	25.00	33.00	34.00	31.50	40.25	20.75	27.88
December	13.22	16.19	17.35	24.00	17.37	15.50	17.00	13.75	13.00	17.25	13.50	12.75	18.30	30.75	33.00	34.00	36.75	36.20	20.00	25.63
Average	*18.08*	*12.86*	*15.59*	*18.63*	*22.43*	*15.19*	*15.48*	*14.94*	*13.53*	*14.22*	*14.84*	*13.00*	*13.92*	*20.07*	*40.32*	*33.25*	*28.95*	*43.21*	*23.22*	*25.23*



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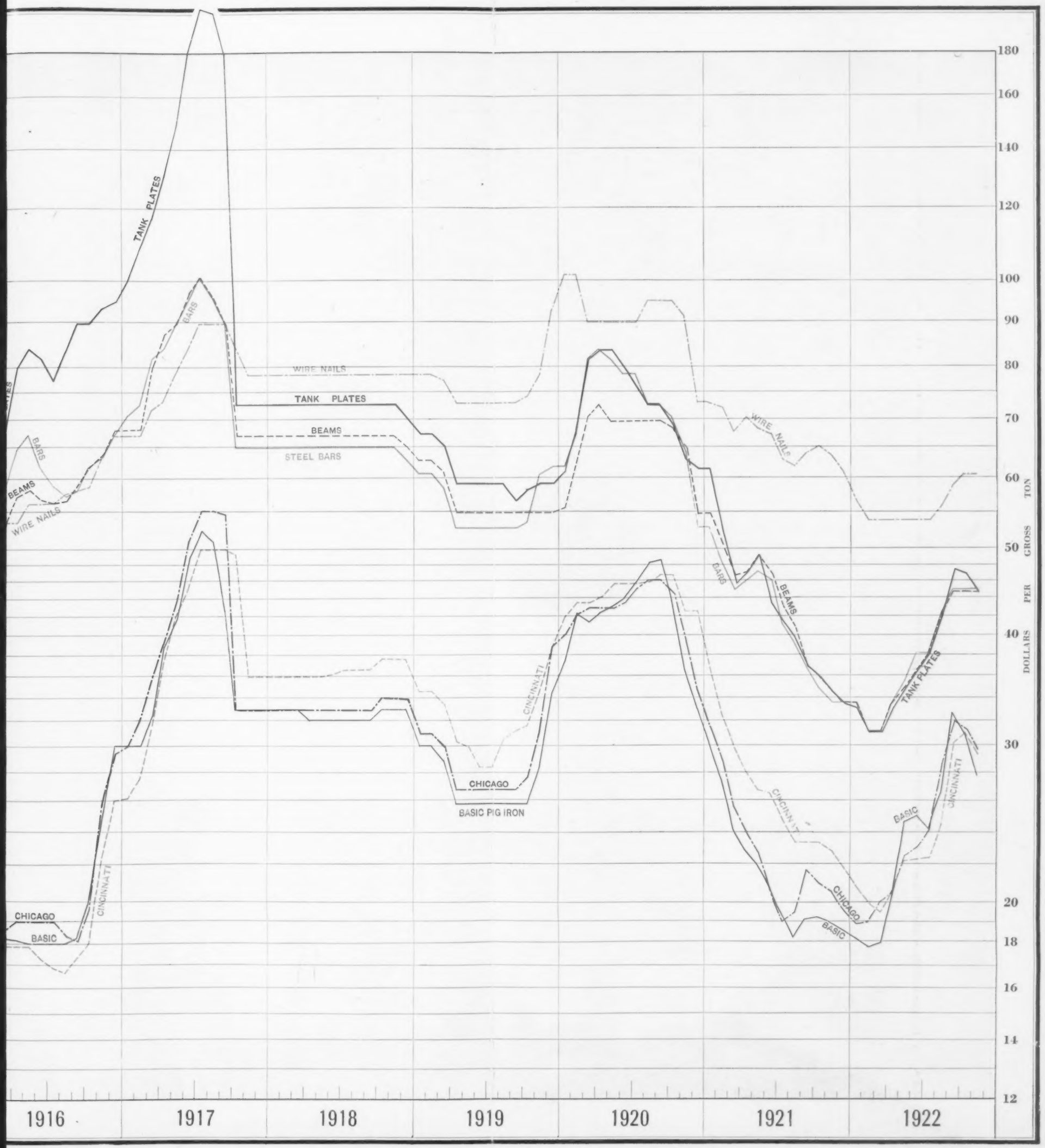

Pig Iron and Finished Steel Since 1904

Iron and Steel Prices for Twenty-One Years

Monthly Averages Computed from the Weekly Market Quotations of THE IRON AGE in the Period of 1902 to 1922

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Bessemer Pig Iron at Pittsburgh, Dollars per Gross Ton (2240 lb.)

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January...	$16.70	$22.15	$13.91	$16.85	$18.35	$23.15	$19.00	$17.34	$19.90	$15.90	$15.05	$18.15	$14.96	$14.59	$21.58	$35.95	$37.25	$33.60	$40.00	$33.96	$21.56
February...	16.93	21.45	13.66	16.41	18.35	22.85	17.90	16.78	19.34	15.90	14.90	18.15	15.09	14.55	21.51	35.95	37.25	33.60	42.90	31.46	21.46
March.....	17.37	21.85	14.25	16.35	18.28	22.85	17.86	16.25	18.60	15.90	15.09	18.15	15.09	14.55	21.75	37.70	37.25	32.54	43.40	28.16	21.46
April.....	18.75	21.28	14.18	16.35	18.19	23.35	17.49	15.78	18.27	15.90	15.15	17.90	14.90	14.55	21.95	42.20	36.15	29.35	43.60	26.96	22.59
May.....	20.75	20.01	13.60	16.16	18.10	24.01	16.93	15.84	17.53	15.90	15.13	17.70	14.90	14.59	21.95	45.15	36.15	29.35	44.03	26.16	26.36
June.....	21.56	19.72	12.81	16.65	18.23	24.27	16.90	16.05	16.60	15.90	15.15	17.14	14.90	14.70	21.95	54.70	36.38	29.35	44.80	24.71	26.96
July.....	21.60	18.89	12.40	14.85	18.41	23.55	16.83	16.46	16.40	15.90	15.20	16.70	14.90	14.95	21.95	57.45	36.60	29.35	47.15	22.84	26.77
August....	21.62	18.35	12.81	15.20	19.00	22.90	16.23	17.03	16.09	15.90	15.46	16.52	14.90	15.95	21.95	54.75	36.60	29.35	49.11	21.96	29.96
September.	21.75	17.22	12.63	15.91	19.54	22.90	15.90	18.05	15.60	15.90	16.15	16.65	14.90	16.85	22.26	48.03	36.60	29.35	50.46	21.96	35.27
October....	21.75	16.05	13.10	16.54	20.35	22.00	15.71	19.53	15.90	15.44	17.80	16.60	14.84	16.95	24.08	37.25	36.60	29.35	49.16	21.96	35.17
November.	21.68	15.18	14.85	17.85	22.85	20.65	16.59	19.90	15.82	15.00	18.02	16.02	14.59	17.51	30.15	37.25	36.60	31.26	41.10	21.96	33.52
December..	21.75	14.40	16.65	18.35	23.75	19.34	17.40	19.90	15.90	15.03	18.15	15.77	14.70	19.65	35.68	37.25	36.60	36.65	36.96	21.96	29.90
Average..	*20.18*	*18.88*	*13.74*	*16.46*	*19.45*	*22.65*	*17.06*	*17.41*	*17.19*	*15.71*	*15.94*	*17.12*	*14.89*	*15.78*	*23.90*	*43.64*	*36.67*	*31.09*	*44.39*	*25.34*	*27.58*

Basic Pig Iron, f.o.b. Mahoning or Shenango Valley Furnace, Dollars per Gross Ton

January...	.....	.....	.....	$15.46	$17.06	$21.90	$16.90	$15.50	$16.87	$13.25	$12.35	$16.41	$12.50	$12.50	$17.81	$30.00	$33.00	$30.00	$37.40	$30.00	$18.15
February..	.....	.....	.....	15.25	16.82	22.00	15.97	15.12	16.31	13.65	12.25	16.30	13.19	12.50	17.69	30.00	33.00	30.00	42.25	27.50	17.75
March.....	.....	.....	.....	15.55	16.85	21.50	15.62	14.94	16.00	13.75	12.81	16.11	13.00	12.50	18.20	32.25	33.00	28.94	41.50	24.20	17.94
April.....	.....	.....	.....	15.06	16.88	21.50	15.25	14.05	15.94	13.75	13.00	15.87	13.00	12.50	18.13	38.75	32.00	25.75	42.40	22.88	20.00
May.....	.....	.....	.....	15.06	17.00	22.90	14.91	14.12	15.19	13.32	13.00	15.15	13.00	12.50	18.00	41.60	32.00	25.75	43.25	23.00	24.60
June.....	.....	.....	$11.76	14.60	16.94	22.40	15.25	14.62	14.70	13.05	13.12	14.50	13.00	12.59	18.00	48.75	32.00	25.75	44.00	20.75	25.00
July.....	.....	.....	11.20	14.00	17.12	21.75	14.51	15.05	14.50	13.12	13.40	14.37	13.00	12.74	18.00	52.50	32.00	25.75	45.85	19.38	24.25
August....	.....	.....	11.69	14.32	17.70	21.25	14.69	15.25	14.12	13.00	13.94	14.06	13.00	14.06	18.00	51.20	32.00	25.75	48.10	18.20	26.60
September.	.....	.....	11.60	14.86	18.44	20.06	14.43	15.90	13.70	12.80	14.37	14.00	13.00	14.75	18.31	42.75	32.00	25.75	48.50	19.13	32.63
October....	.....	.....	12.19	15.25	19.55	19.50	14.04	16.94	13.15	12.52	15.98	13.90	12.81	15.00	19.88	33.00	33.00	25.75	43.75	19.19	30.90
November.	.....	.....	14.00	16.87	21.37	18.12	14.72	17.25	13.25	12.42	16.37	13.09	12.48	15.75	25.10	33.00	33.00	28.31	36.50	19.00	27.75
December..	.....	.....	15.70	16.75	21.50	17.50	15.60	17.05	13.40	12.25	16.50	12.71	12.50	17.50	30.00	33.00	33.00	34.25	33.00	18.63	24.81
Average..	.....	.....	*12.59*	*15.25*	*18.10*	*20.87*	*15.16*	*15.48*	*14.76*	*13.07*	*13.98*	*14.71*	*13.87*	*13.74*	*19.76*	*38.90*	*32.50*	*27.65*	*42.81*	*21.74*	*24.80*

Southern No. 2 Foundry Pig Iron at Cincinnati, Dollars per Gross Ton

January...	$14.55	$21.65	$12.37	$16.25	$16.75	$26.00	$16.15	$16.25	$17.25	$14.25	$13.25	$16.95	$13.88	$12.40	$17.90	$26.10	$35.90	$34.60	$41.80	$36.75	$20.70
February...	14.75	21.50	12.12	16.25	16.75	26.00	15.75	16.13	17.06	14.25	13.31	16.69	13.81	12.40	17.90	27.53	35.90	34.60	43.60	32.63	20.00
March.....	14.75	21.37	12.10	16.25	16.65	26.00	15.50	15.05	16.30	14.25	13.50	16.31	14.00	12.27	17.90	31.90	35.90	33.54	43.60	29.80	19.50
April.....	16.87	20.15	12.50	16.25	16.63	25.06	15.20	14.25	15.37	14.25	13.75	15.65	13.75	12.34	17.90	37.40	35.90	30.35	44.00	28.00	20.38
May.....	18.35	18.87	12.25	15.81	16.75	24.25	14.75	14.50	15.00	13.95	14.15	14.94	13.75	12.40	17.90	41.90	35.90	29.85	45.60	26.70	22.10
June.....	20.19	17.75	11.80	14.65	16.44	24.10	15.25	14.70	14.85	13.44	14.25	14.06	13.63	12.50	17.34	45.15	36.08	28.39	45.60	26.38	23.00
July.....	20.75	16.15	11.81	13.94	16.06	23.85	15.00	15.75	14.75	13.25	14.70	13.75	13.30	12.71	16.90	49.90	36.60	28.35	45.60	24.75	22.30
August....	23.06	15.19	12.00	14.40	17.30	23.00	15.25	16.38	14.31	13.45	15.06	14.06	13.25	13.71	16.70	49.90	36.60	30.40	45.78	23.50	24.35
September.	25.00	14.75	12.00	14.37	18.69	21.50	15.65	17.35	14.25	13.31	15.87	14.25	13.25	14.15	17.28	49.90	36.60	31.25	46.50	23.50	29.55
October....	25.65	13.50	12.81	15.31	20.00	20.95	15.75	17.88	14.25	13.25	16.80	14.35	12.90	14.78	18.03	49.38	37.60	31.60	46.50	23.50	30.85
November.	23.62	12.00	15.19	16.60	23.38	19.50	16.00	17.75	14.25	13.20	17.25	13.87	12.90	16.15	22.40	35.90	37.60	34.35	42.50	22.90	27.55
December..	22.44	12.05	15.85	16.75	25.00	17.00	16.25	17.45	14.25	13.19	17.25	13.95	12.50	17.10	25.90	35.90	37.60	38.60	42.50	21.75	26.93
Average..	*20.00*	*17.08*	*12.73*	*15.57*	*18.37*	*23.10*	*15.54*	*16.12*	*15.16*	*13.67*	*14.93*	*14.90*	*13.41*	*13.58*	*18.67*	*40.07*	*36.52*	*32.16*	*44.47*	*26.68*	*23.93*

Local No. 2 Foundry Pig Iron at Chicago (at Furnace), Dollars per Gross Ton

January...	$16.25	$23.45	$14.47	$17.85	$19.60	$25.85	$18.45	$17.35	$19.00	$15.50	$14.00	$17.90	$13.75	$13.00	$18.50	$30.00	$33.00	$31.00	$40.00	$31.50	$18.90
February...	16.85	23.35	13.91	17.85	19.41	25.85	18.16	16.75	19.00	15.50	14.00	17.31	14.00	13.00	18.50	32.00	33.00	31.00	42.25	29.00	19.00
March.....	18.51	23.22	14.05	17.80	19.35	26.10	17.85	16.50	18.30	15.50	14.00	17.25	14.25	12.95	18.70	36.00	33.00	29.94	43.00	25.60	20.00
April.....	18.97	22.87	14.35	17.60	19.10	26.35	17.73	16.50	17.50	15.00	14.00	17.00	14.25	13.00	19.00	39.25	33.00	26.75	43.00	24.00	20.50
May.....	20.85	20.72	13.85	17.60	18.90	26.85	17.63	16.50	17.06	15.00	14.50	16.00	14.06	13.00	19.00	43.80	33.00	26.75	43.00	22.80	22.60
June.....	21.85	19.85	13.70	17.00	18.54	26.60	17.73	16.50	16.75	15.00	14.50	15.62	13.69	13.00	19.00	51.00	33.00	26.75	43.40	20.75	23.25
July.....	21.60	18.25	13.60	16.47	18.60	25.55	17.55	17.00	16.56	14.87	14.70	14.70	13.75	13.00	19.00	55.00	33.00	26.75	45.25	19.00	24.25
August....	22.10	17.22	13.60	16.60	19.45	24.85	17.35	17.13	16.50	14.50	15.37	15.00	13.69	13.44	18.40	55.00	33.00	26.75	46.00	19.55	28.60
September.	23.35	16.41	13.85	16.60	20.16	24.10	17.05	18.70	16.40	14.50	16.00	15.00	13.25	13.90	18.13	54.67	33.00	26.75	46.00	21.75	32.00
October....	23.35	15.70	14.10	17.66	21.48	22.45	16.85	19.00	16.00	14.46	17.00	15.00	12.94	14.63	19.63	33.00	34.00	27.75	44.50	21.00	31.40
November.	23.35	15.10	15.98	19.15	24.70	20.66	17.10	19.00	16.00	14.09	17.75	14.87	12.56	17.13	25.80	33.00	34.00	31.00	39.40	20.60	29.75
December..	23.35	14.81	16.95	19.60	25.85	18.80	17.35	19.00	16.00	14.00	18.00	14.30	13.00	18.10	29.50	33.00	34.00	38.75	34.50	19.63	28.00
Average..	*20.87*	*19.85*	*14.37*	*17.65*	*20.43*	*24.60*	*17.57*	*17.49*	*17.09*	*14.83*	*15.38*	*15.83*	*13.60*	*14.01*	*20.86*	*41.31*	*33.25*	*29.16*	*43.53*	*22.05*	*24.85*

Standard Brands Eastern Pennsylvania No. 2X Foundry Pig Iron at Philadelphia, Dollars per Gross Ton

January...	$16.75	$22.45	$14.69	$17.50	$18.50	$24.80	$18.25	$17.25	$19.00	$15.50	$14.85	$18.25	$14.65	$14.25	$19.94	$30.10	$34.25	$36.15	$44.10	$33.34	$21.34
February...	17.19	22.25	14.50	17.50	18.50	25.87	18.25	17.00	18.69	15.50	14.85	18.25	14.94	14.25	20.00	31.88	34.25	36.15	45.10	31.09	21.09
March.....	18.81	22.25	14.80	17.56	18.35	25.00	18.12	16.37	18.00	15.50	14.92	17.77	15.00	14.25	20.05	37.31	34.25	34.39	45.53	27.59	21.26
April.....	19.62	21.87	15.00	17.75	18.44	24.81	17.65	16.20	17.75	15.50	15.00	17.40	15.00	14.25	20.50	41.38	34.25	31.90	46.85	26.26	23.62
May.....	19.75	20.06	14.75	17.81	18.50	25.55	16.94	16.06	17.00	15.50	15.18	16.75	14.81	14.25	20.50	43.60	34.25	30.70	47.10	25.71	26.09
June.....	20.94	19.19	14.50	16.75	18.44	24.62	16.63	16.42	16.55	15.25	15.31	16.19	14.75	14.25	19.94	48.19	34.29	29.50	47.18	25.50	27.06
July.....	22.30	18.10	14.31	16.12	18.25	23.06	16.50	16.50	16.25	15.00	15.70	15.60	14.75	14.31	19.75	53.13	34.40	29.08	48.15	23.55	27.92
August....	22.00	16.87	14.25	16.25	19.00	21.90	16.50	17.00	16.00	15.00	15.87	15.60	14.75	14.94	19.55	53.00	34.40	29.60	51.96	20.64	32.26
September.	22.00	16.12	14.25	16.43	20.44	20.50	16.62	18.05	16.00	15.00	16.59	15.83	14.75	16.00	19.50	51.67	34.40	30.70	53.81	21.22	34.83
October....	22.12	15.20	14.43	17.25	21.12	19.85	16.75	18.69	15.81	15.00	17.60	15.95	14.63	16.25	20.31	34.25	38.85	32.10	52.53	22.23	32.54
November.	23.37	15.00	15.75	18.05	23.30	18.94	17.00	19.00	15.68	14.95	18.25	15.56	14.50	17.12	24.90	34.25	39.15	35.35	44.99	22.74	30.39
December..	23.00	15.00	16.90	18.25	24.00	18.84	17.25	19.00	15.50	14.85	18.25	15.20	14.25	19.05	29.25	34.25	39.15	40.10	35.54	21.82	28.86
Average..	*20.05*	*18.70*	*14.84*	*17.27*	*19.74*	*23.81*	*17.20*	*17.20*	*16.85*	*15.21*	*16.03*	*16.53*	*14.73*	*15.26*	*21.15*	*43.06*	*35.49*	*30.98*	*46.83*	*23.14*	*27.27*

Mahoning and Shenango Valley No. 2 Foundry Iron, at Furnace, Dollars per Gross Ton

	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January.....	$22.30	$13.00	$16.12	$17.31	$24.60	$16.80	$15.44	$17.00	$13.75	$13.00	$17.50	$12.85	$13.00	$18.50	$31.00	$33.00	$31.00	$39.40	$21.88	$19.30
February.....	21.95	12.47	16.00	17.25	24.12	16.00	15.06	16.69	13.75	13.00	17.00	13.19	13.00	18.31	32.00	33.00	31.00	41.50	28.00	18.88
March.....	22.00	12.91	16.00	17.12	24.00	15.56	14.50	16.10	13.75	13.12	16.69	13.25	13.00	18.50	34.75	33.00	29.94	41.25	25.90	19.00
April.....	20.99	13.01	16.00	16.50	24.00	15.15	14.00	15.62	13.75	13.25	15.55	13.25	12.75	18.50	39.75	33.00	26.75	42.80	24.75	20.75
May.....	20.32	12.47	15.55	16.30	25.00	14.87	14.19	15.31	13.75	13.25	14.62	13.00	12.94	18.20	42.40	33.00	26.75	44.25	23.50	23.80
June.....	19.37	11.96	14.81	16.19	25.12	15.00	14.90	14.75	13.56	13.25	14.06	13.00	12.69	18.13	50.25	33.00	26.75	45.00	22.10	24.00
July.....	18.02	11.67	14.25	16.44	22.80	14.80	15.19	14.31	13.50	13.37	13.87	13.00	12.70	18.25	54.50	33.00	26.75	45.00	20.13	24.25
August.....	16.34	11.87	14.15	17.71	22.50	14.50	15.31	14.15	13.50	13.69	14.00	13.00	13.62	18.25	53.20	33.00	26.75	47.00	19.63	32.60
September.....	14.98	11.71	14.56	19.56	20.87	14.47	15.75	13.75	13.44	14.44	14.00	13.00	14.70	18.39	47.00	33.00	26.75	49.40	21.00	34.88
October.....	14.09	12.50	15.50	21.35	19.80	14.36	17.12	13.94	13.37	16.10	13.84	12.90	14.87	20.00	33.00	34.00	26.75	46.50	21.00	31.80
November.....	13.32	14.60	16.83	23.87	19.00	15.25	17.25	13.90	13.20	16.94	13.50	12.75	15.50	25.00	33.00	34.00	31.50	40.25	20.75	27.88
December.....	13.22	16.19	17.35	24.00	17.37	15.50	17.00	13.75	13.00	17.25	13.50	12.75	18.30	30.75	33.00	34.00	36.75	36.20	20.00	25.63
*Average.....	*18.08*	*12.86*	*15.59*	*18.63*	*22.43*	*15.19*	*15.43*	*14.94*	*13.53*	*14.22*	*14.84*	*13.00*	*13.92*	*20.07*	*40.32*	*33.25*	*28.95*	*43.21*	*23.22*	*25.23*

Gray Forge Pig Iron, Philadelphia and Vicinity, Gross Ton

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$15.75	$21.75	$13.50	$16.25	$16.75	$23.50	$16.50	$16.25	$17.25	$14.25	$14.25	$17.65	$14.00	$13.50	$18.44	$28.38	$32.00	$33.90	$40.23	$32.78	$20.60
February	15.75	21.25	13.50	15.75	17.00	23.50	16.50	16.25	17.50	14.25	14.25	17.31	14.00	13.44	19.00	29.75	32.00	33.90	40.50	30.90	20.50
March	17.50	20.00	12.75	16.25	16.75	23.50	16.50	15.50	16.90	14.60	14.25	16.87	14.00	13.25	19.00	31.94	32.00	32.84	43.00	26.86	20.50
April	18.25	20.00	13.75	16.25	16.75	23.00	16.00	15.00	16.62	14.75	14.37	16.56	14.00	13.25	19.13	38.50	32.00	29.65	43.00	25.26	21.25
May	19.00	19.50	13.75	16.00	16.50	23.25	16.00	15.00	16.00	14.70	14.50	15.81	13.81	13.25	19.50	40.40	32.00	29.21	43.00	25.26	23.80
June	19.25	18.25	13.50	15.75	16.25	23.00	15.25	15.25	15.65	14.50	14.62	15.37	13.75	13.25	19.25	44.31	32.00	26.25	43.00	24.69	24.25
July	21.75	18.12	13.25	14.50	16.10	22.50	15.25	15.50	15.37	14.50	14.87	14.95	13.75	13.25	18.50	50.05	32.00	25.92	43.00	22.50	25.50
August	21.00	15.50	12.50	15.00	16.50	20.50	15.25	16.25	15.00	14.30	15.37	14.62	13.75	14.50	18.50	49.56	32.00	26.60	45.46	21.20	29.00
September	21.00	14.75	13.00	15.00	17.75	19.50	15.50	17.00	14.75	14.45	15.87	14.56	13.75	15.13	18.50	44.25	32.00	27.00	47.10	20.00	31.00
October	21.00	14.50	12.75	15.75	18.25	18.75	15.50	17.50	14.50	14.25	16.87	15.00	13.62	15.25	19.35	32.20	36.60	28.69	47.10	20.50	31.00
November	22.00	14.00	14.00	16.25	20.00	17.00	15.75	18.00	14.37	14.25	17.62	14.75	13.50	16.05	23.75	32.00	36.60	32.40	44.64	22.50	29.14
December	22.25	14.00	15.50	16.50	22.00	16.75	16.00	18.00	14.25	14.25	17.75	14.58	13.50	17.63	27.69	32.00	36.90	36.10	38.74	21.69	28.14
Average	*19.54*	*17.64*	*13.48*	*15.77*	*17.55*	*21.23*	*15.83*	*16.29*	*15.67*	*14.42*	*15.38*	*15.67*	*13.79*	*14.31*	*20.05*	*37.78*	*33.18*	*30.21*	*43.23*	*24.51*	*25.39*

Malleable Pig Iron at Chicago, Dollars per Gross Ton

	1903	1904	1905	1906	1907	*1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$23.24	$14.50	$17.50	$19.37	$26.00	$18.60	$17.09	$19.00	$15.50	$14.35	$17.90	$13.88	$13.00	$19.00	$30.94	$33.50	$31.50	$40.50	$32.00	$18.90
February	23.00	14.50	17.50	19.19	26.00	18.25	16.75	19.00	15.50	14.14	17.31	13.94	13.00	19.00	31.75	33.50	31.50	42.75	29.38	19.13
March	22.87	14.00	17.50	19.00	26.25	17.50	16.50	18.40	15.50	14.00	17.25	14.25	13.00	19.40	35.40	33.50	30.44	43.50	25.80	20.00
April	21.82	14.00	17.50	18.77	26.50	17.50	16.50	17.50	15.25	14.00	17.05	14.25	13.00	19.50	39.00	33.50	27.25	43.50	24.00	20.50
May	20.77	14.00	17.37	18.35	26.60	17.56	16.66	17.06	15.00	14.40	16.00	14.06	13.00	19.50	43.60	33.50	27.25	43.50	23.00	22.60
June	19.50	13.85	16.65	18.00	26.25	17.37	16.50	16.75	15.00	14.50	15.62	13.88	13.00	19.50	50.25	33.50	27.25	43.50	21.50	23.25
July	18.66	13.75	16.37	18.37	25.62	17.50	16.90	16.56	15.00	14.50	14.65	14.00	13.00	19.50	55.00	33.50	27.25	45.25	19.00	24.25
August	17.59	13.75	16.50	18.95	24.80	17.50	17.12	16.50	14.80	15.10	15.00	14.00	13.44	19.00	55.00	33.50	27.25	46.50	19.60	28.60
September	16.94	13.50	16.56	20.12	24.40	17.26	18.50	16.40	14.50	16.25	15.00	13.25	14.30	19.00	54.75	33.50	27.25	46.50	21.75	32.00
October	16.25	13.75	17.37	21.32	22.40	17.00	18.50	16.06	14.50	17.10	15.20	13.00	15.25	19.88	33.50	34.50	28.25	45.75	21.00	31.40
November	15.00	15.87	19.00	24.16	20.25	17.00	19.00	16.00	14.35	17.87	14.87	12.88	17.13	25.80	33.50	34.50	31.50	39.90	20.60	29.75
December	14.50	16.50	19.50	26.00	18.75	17.00	19.00	16.00	14.35	18.00	14.63	12.90	18.20	29.50	33.50	34.50	39.50	35.00	19.63	28.00
Average	*19.18*	*14.33*	*17.44*	*20.13*	*24.49*	*17.50*	*17.42*	*17.10*	*14.94*	*15.35*	*15.87*	*13.69*	*14.11*	*20.72*	*41.35*	*33.75*	*29.68*	*43.01*	*23.11*	*24.87*

*From this time on the prices are given as at furnace near Chicago, and 35c. to 50c. per ton should be added to get the price delivered to Chicago foundries.

Lake Superior Charcoal Pig Iron at Chicago, Gross Ton

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$19.25	$25.60	$16.62	$18.50	$20.40	$26.80	$22.50	$19.50	$19.50	$17.87	$16.00	$18.15	$15.25	$15.75	$19.50	$31.75	$37.50	$38.85	$48.75	$42.50	$31.10
February	20.25	26.50	15.87	18.50	20.13	27.00	21.38	19.50	19.50	17.50	15.95	18.00	15.25	15.75	19.75	33.75	37.50	38.85	58.38	39.50	29.38
March	20.65	26.50	15.00	18.50	19.75	26.75	21.25	19.50	19.30	17.50	15.75	18.00	15.25	15.75	19.75	36.75	37.50	38.85	58.20	38.50	26.00
April	21.50	25.30	15.19	18.50	19.44	26.50	20.30	19.50	19.00	17.50	15.75	18.00	15.45	15.75	19.75	40.25	37.50	31.75	57.25	38.50	26.50
May	22.80	24.12	15.00	17.75	19.05	27.40	20.00	19.50	18.62	17.25	15.75	18.00	15.75	15.75	19.75	48.15	37.50	31.75	57.50	37.50	28.40
June	23.50	24.00	14.70	17.00	19.00	27.50	20.00	19.50	18.50	16.80	16.75	16.81	15.75	15.75	19.75	52.88	37.62	31.75	57.50	37.50	29.75
July	25.00	22.20	14.50	16.50	19.06	27.00	20.00	19.50	18.50	16.50	16.25	15.65	15.75	15.75	19.75	57.75	38.00	31.75	57.50	36.37	31.65
August	25.75	20.62	14.87	16.40	19.35	27.20	19.50	19.50	18.50	16.50	16.25	14.69	15.75	16.00	19.75	58.00	38.00	32.25	57.70	33.60	34.05
September	26.00	19.00	14.75	16.87	20.13	27.00	19.50	19.50	18.40	16.50	17.12	15.25	15.75	15.85	19.75	58.00	38.00	32.75	58.50	33.00	36.15
October	26.00	18.10	15.31	18.25	21.50	26.20	19.50	19.50	18.12	16.50	18.65	15.25	15.75	15.75	20.25	37.50	38.00	33.44	58.50	31.50	36.15
November	26.00	17.12	16.37	19.20	24.63	25.12	19.50	19.50	18.00	16.50	18.65	15.25	15.75	17.00	26.46	37.50	38.70	38.50	55.75	31.50	36.15
December	25.25	16.50	17.80	20.00	26.13	24.25	19.50	19.50	18.00	16.37	18.75	15.25	15.75	18.65	31.75	37.50	38.70	43.00	49.13	31.50	34.65
Average	*23.50*	*22.13*	*15.50*	*18.00*	*20.71*	*26.56*	*20.24*	*19.50*	*18.66*	*16.94*	*16.80*	*16.53*	*15.60*	*16.13*	*21.33*	*44.15*	*37.88*	*35.29*	*56.22*	*35.96*	*31.66*

Southern No. 2 Foundry Pig Iron at Birmingham, Dollars per Gross Ton

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$11.80	$20.00	$ 9.94	$13.94	$14.50	$23.10	$13.65	$13.00	$14.13	$11.00	$10.00	$13.56	$10.63	$ 9.50	$15.00	$23.20	$33.00	$31.00	$38.75	$32.25	$16.20
February	12.00	18.88	9.69	13.94	14.25	22.25	13.50	13.00	14.00	11.00	10.06	13.38	10.56	9.50	15.00	24.63	33.00	31.00	40.00	28.13	15.00
March	12.13	18.38	9.55	13.85	14.37	22.50	13.00	12.50	13.42	11.00	10.25	13.06	10.70	9.35	15.00	29.00	33.00	29.44	40.00	25.30	15.00
April	14.75	17.00	10.00	13.56	14.00	22.50	12.15	11.40	12.75	11.00	10.55	12.40	10.50	9.44	15.00	34.50	33.00	26.75	40.50	23.50	15.88
May	16.94	16.44	9.75	13.19	14.00	22.70	11.63	11.38	12.00	10.70	10.94	11.69	10.50	9.44	15.00	39.00	33.00	26.75	42.00	22.20	17.60
June	18.00	14.75	9.35	12.70	13.81	22.50	12.00	11.50	12.00	10.19	11.00	10.81	10.45	9.65	14.50	42.25	33.00	25.25	42.00	21.88	18.38
July	18.80	13.70	9.50	11.63	13.56	21.19	11.90	12.45	12.00	10.00	11.45	10.50	10.00	9.75	14.00	47.00	33.00	25.15	42.00	20.25	18.25
August	21.25	12.75	9.50	12.00	14.55	20.40	12.38	13.25	11.50	10.20	11.81	10.81	10.00	10.75	13.80	47.00	33.00	27.38	42.00	19.00	20.10
September	23.00	12.00	9.50	12.00	15.63	18.50	13.19	14.00	11.50	10.06	12.75	11.00	10.00	11.50	14.38	47.00	33.00	27.95	42.00	19.00	26.00
October	23.40	11.06	10.90	13.00	15.87	18.50	13.00	15.00	11.50	10.00	13.50	11.25	10.00	12.13	15.50	33.00	34.00	28.00	42.00	19.00	26.80
November	23.50	9.69	12.50	14.25	20.90	18.00	13.00	15.00	11.00	9.94	14.00	10.63	10.00	13.40	20.13	33.00	34.00	30.75	38.00	18.40	23.50
December	22.38	9.50	13.69	14.50	22.56	15.00	13.00	14.40	11.00	9.94	14.00	10.70	9.60	14.38	23.00	33.00	33.40	35.20	38.00	17.33	22.88
Average	*18.16*	*14.51*	*10.32*	*13.21*	*15.67*	*20.59*	*12.70*	*13.07*	*12.23*	*10.42*	*11.69*	*11.65*	*10.24*	*10.73*	*15.86*	*36.05*	*33.20*	*28.72*	*40.60*	*22.19*	*19.63*

THE IRON AGE Composite Iron and Steel Prices

Composite Pig Iron Price

Average of THE IRON AGE *quotations on foundry and basic pig irons; basic iron at Valley furnace; foundry iron an average of Chicago, Birmingham and Philadelphia. Quoted in dollars per gross ton.*

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$15.82	$22.06	$13.47	$15.95	$17.30	$23.24	$16.84	$15.68	$17.12	$13.63	$12.65	$16.49	$12.76	$12.38	$17.81	$28.88	$33.21	$31.36	$39.08	$31.18	$18.48
February	16.14	21.47	13.17	15.84	17.10	23.33	16.30	15.35	16.77	13.83	12.61	16.31	13.18	12.38	17.76	29.75	33.21	31.36	42.35	28.45	18.14
March	16.93	21.54	13.43	15.98	17.10	23.02	15.97	15.03	16.29	13.88	12.93	16.07	13.16	12.34	18.06	32.18	33.21	30.10	42.17	25.18	18.35
April	18.27	20.93	13.65	15.68	17.03	23.03	15.55	14.38	15.97	13.79	13.09	15.74	13.13	12.37	18.15	38.56	32.71	27.11	42.93	23.73	20.00
May	19.96	19.54	13.19	15.63	17.07	23.97	15.16	14.38	15.27	13.53	13.27	14.98	13.06	12.37	18.08	41.87	32.71	26.91	43.64	22.78	23.35
June	20.91	18.83	12.66	15.04	16.94	23.47	15.35	14.71	14.90	13.27	13.36	14.35	12.97	12.45	17.91	47.95	32.71	26.46	44.09	21.73	23.95
July	21.25	17.79	11.84	14.37	16.96	22.51	14.91	15.18	14.72	13.21	13.68	13.99	12.92	12.55	17.79	52.11	32.73	26.37	45.44	20.22	23.86
August	21.70	16.98	12.07	14.64	17.68	21.82	15.05	15.52	14.39	13.12	14.15	13.93	12.91	13.55	17.63	51.43	32.73	26.83	47.38	18.97	26.69
September	22.27	16.03	12.07	14.94	18.59	20.55	15.03	16.41	14.17	12.99	14.74	13.97	12.83	14.28	17.82	46.93	32.73	27.11	47.83	19.89	31.78
October	22.35	15.02	12.67	15.61	19.52	19.88	14.79	17.25	13.79	12.84	16.01	13.93	12.67	14.67	19.18	33.21	34.31	27.52	45.05	19.97	30.57
November	22.54	14.23	14.37	17.01	22.17	18.66	15.21	17.46	13.74	12.71	16.52	13.39	12.42	15.82	24.36	33.21	34.36	30.34	38.65	19.79	27.82
December	22.33	13.75	15.77	17.10	22.82	17.52	15.73	17.26	13.78	12.59	16.63	13.06	12.39	17.34	28.63	33.21	34.26	36.13	34.51	19.11	25.70
Average	*20.04*	*18.18*	*13.20*	*15.65*	*18.36*	*21.75*	*15.49*	*15.72*	*15.08*	*13.28*	*14.14*	*14.68*	*12.87*	*13.54*	*19.43*	*36.11*	*33.24*	*28.97*	*42.76*	*22.58*	*24.06*

Composite Price of Finished Steel

Compiled from THE IRON AGE *quotations on steel bars, beams, tank plates, plain wire, open-hearth rails, black pipe and black sheets. Quoted in cents per pound.*

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	2.026	1.921	1.740	1.713	1.747	1.887	1.923	1.82	1.741	1.615	1.424	1.771	1.451	1.383	2.06	3.384	3.549	3.371	3.158	3.057	2.050
February	2.005	1.875	1.751	1.725	1.749	1.899	1.92	1.772	1.736	1.62	1.40	1.766	1.477	1.395	2.203	3.501	3.549	3.371	3.486	2.918	2.007
March	2.075	1.886	1.769	1.783	1.746	1.905	1.92	1.599	1.727	1.623	1.394	1.786	1.473	1.413	2.447	3.739	3.549	3.282	3.743	2.764	2.014
April	2.083	1.886	1.764	1.793	1.741	1.931	1.92	1.577	1.727	1.627	1.433	1.79	1.446	1.437	2.611	4.110	3.549	3.031	3.842	2.737	2.075
May	2.064	1.886	1.757	1.799	1.741	1.933	1.92	1.506	1.72	1.62	1.456	1.727	1.424	1.433	2.75	4.562	3.549	3.021	3.804	2.764	2.113
June	2.070	1.886	1.737	1.779	1.763	1.927	1.851	1.506	1.707	1.556	1.47	1.687	1.399	1.444	2.689	5.004	3.549	3.021	3.756	2.643	2.148
July	2.106	1.884	1.702	1.779	1.763	1.927	1.82	1.543	1.657	1.546	1.504	1.667	1.40	1.471	2.64	5.334	3.549	3.021	3.885	2.455	2.169
August	2.136	1.879	1.674	1.783	1.763	1.927	1.82	1.581	1.636	1.539	1.553	1.624	1.446	1.511	2.682	5.249	3.549	3.021	3.967	2.341	2.292
September	2.126	1.871	1.621	1.786	1.763	1.934	1.82	1.616	1.627	1.513	1.61	1.591	1.47	1.559	2.765	5.049	3.549	3.004	3.956	2.248	2.419
October	2.047	1.867	1.620	1.72	1.78	1.934	1.82	1.664	1.613	1.441	1.659	1.559	1.446	1.634	2.856	3.470	3.55	3.052	3.81	2.218	2.461
November	1.991	1.812	1.652	1.723	1.82	1.934	1.82	1.674	1.613	1.407	1.70	1.565	1.397	1.769	3.021	3.444	3.549	3.084	3.566	2.129	2.445
December	1.953	1.761	1.691	1.727	1.87	1.934	1.82	1.727	1.611	1.399	1.725	1.463	1.366	1.941	3.278	3.441	3.461	3.11	3.114	2.107	2.439
Average	*2.057*	*1.868*	*1.707*	*1.759*	*1.77*	*1.923*	*1.864*	*1.632*	*1.662*	*1.542*	*1.529*	*1.663*	*1.434*	*1.534*	*2.671*	*4.188*	*3.542*	*3.115*	*3.675*	*2.532*	*2.220*

Billets and Finished Steel

Bessemer Steel Billets at Pittsburgh, Dollars per Gross Ton

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January...	$27.50	$29.60	$23.00	$22.75	$26.25	$29.40	$28.00	$25.00	$27.50	$23.00	$20.00	$28.30	$20.13	$19.25	$32.00	$63.00	$47.50	$43.50	$48.00	$43.50	$28.00
February..	29.37	29.87	23.00	23.50	26.50	29.50	28.00	25.00	27.50	23.00	20.00	28.50	21.00	19.50	33.50	65.00	47.50	43.50	55.25	42.25	28.00
March....	31.25	30.62	23.00	24.00	26.70	29.00	28.00	23.00	27.50	23.00	19.75	28.50	21.00	19.70	42.40	66.25	47.50	42.25	60.00	38.40	28.00
April.....	31.50	30.25	23.00	24.00	27.00	30.12	28.00	23.00	26.75	23.00	20.00	28.50	20.80	20.00	45.00	73.75	47.50	38.50	60.00	37.50	29.50
May.....	32.20	30.37	23.00	23.50	26.40	30.30	28.00	23.00	26.12	22.60	20.80	27.37	20.00	20.00	45.00	86.00	47.50	38.50	60.00	37.00	34.00
June.....	32.37	28.87	23.00	22.00	26.63	29.62	25.75	23.00	25.30	21.00	20.87	26.50	19.50	20.50	43.50	98.75	47.50	38.50	61.00	37.00	35.00
July.....	31.75	27.60	23.00	22.00	27.25	30.00	25.00	23.50	25.00	21.00	21.50	26.60	19.00	21.38	41.00	100.00	47.50	38.50	62.50	32.25	35.00
August....	31.06	27.00	23.00	24.00	27.80	29.25	25.00	24.13	24.62	21.00	22.12	26.00	20.25	23.13	44.20	86.00	47.50	38.50	61.00	29.60	36.10
September.	29.50	27.00	20.00	25.00	28.00	29.37	25.00	25.00	24.40	20.75	23.62	24.87	21.00	24.10	45.00	66.25	47.50	38.50	58.74	29.00	39.50
October...	29.70	27.00	19.50	25.62	28.00	28.20	25.00	26.25	23.75	20.00	26.00	23.30	20.00	24.63	46.25	49.38	47.50	38.50	55.00	29.00	40.00
November.	28.50	24.00	20.25	26.00	28.88	28.00	25.00	27.13	23.30	19.50	27.00	21.00	19.25	26.50	52.00	47.50	47.50	41.38	49.70	29.00	37.75
December.	29.12	23.00	21.20	26.00	29.50	28.00	25.00	27.50	23.00	19.25	27.00	20.00	19.00	30.60	57.50	47.50	45.50	46.00	43.50	29.00	36.50
Average..	*30.32*	*27.93*	*22.08*	*24.03*	*27.41*	*29.23*	*26.31*	*24.61*	*25.40*	*21.43*	*22.39*	*25.79*	*20.08*	*22.44*	*43.95*	*70.78*	*47.33*	*40.51*	*56.22*	*34.46*	*33.95*

Soft Steel Bars at Pittsburgh, Cents per Pound

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January...	1.50	1.60	1.30	1.40	1.50	1.60	1.60	1.40	1.50	1.40	1.15	1.70	1.20	1.10	2.03	3.15	2.90	2.70	2.75	2.35	1.50
February..	1.51	1.60	1.30	1.40	1.50	1.60	1.60	1.35	1.50	1.40	1.12	1.70	1.20	1.10	2.31	3.25	2.90	2.70	3.00	2.15	1.39
March....	1.60	1.60	1.33	1.50	1.50	1.60	1.60	1.20	1.45	1.40	1.10	1.85	1.20	1.15	2.65	3.63	2.90	2.61	3.63	2.00	1.39
April.....	1.60	1.60	1.35	1.50	1.50	1.60	1.60	1.15	1.45	1.40	1.16	1.84	1.15	1.20	2.88	3.75	2.90	2.35	3.75	2.05	1.50
May.....	1.60	1.60	1.35	1.50	1.50	1.60	1.60	1.19	1.45	1.37	1.20	1.70	1.14	1.20	3.00	4.00	2.90	2.35	3.63	2.10	1.58
June.....	1.60	1.60	1.35	1.46	1.50	1.60	1.45	1.20	1.45	1.25	1.20	1.60	1.11	1.21	2.75	4.25	2.90	2.35	3.50	2.05	1.70
July.....	1.60	1.60	1.35	1.50	1.50	1.60	1.40	1.27	1.45	1.23	1.25	1.50	1.12	1.25	2.63	4.50	2.90	2.35	3.50	1.84	1.70
August....	1.60	1.60	1.35	1.50	1.50	1.60	1.40	1.32	1.40	1.20	1.30	1.40	1.19	1.30	2.56	4.30	2.90	2.35	3.25	1.74	1.88
September.	1.60	1.60	1.31	1.50	1.50	1.60	1.40	1.39	1.40	1.19	1.37	1.40	1.20	1.34	2.60	4.00	2.90	2.35	3.25	1.63	2.00
October...	1.60	1.60	1.30	1.50	1.50	1.60	1.40	1.51	1.40	1.12	1.45	1.39	1.15	1.44	2.75	2.90	2.90	2.39	3.13	1.55	2.00
November.	1.60	1.37	1.31	1.50	1.54	1.60	1.40	1.50	1.40	1.08	1.55	1.29	1.10	1.62	2.83	2.90	2.90	2.69	2.87	1.50	2.00
December.	1.60	1.30	1.34	1.50	1.60	1.60	1.40	1.50	1.40	1.12	1.66	1.21	1.07	1.84	3.00	2.90	2.80	2.75	2.35	1.50	2.00
Average..	*1.58*	*1.56*	*1.33*	*1.48*	*1.51*	*1.60*	*1.49*	*1.33*	*1.44*	*1.26*	*1.29*	*1.53*	*1.15*	*1.31*	*2.67*	*3.63*	*2.89*	*2.50*	*3.22*	*1.87*	*1.72*

Tank Plates at Pittsburgh, Cents per Pound

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January ..	1.60	1.75	1.60	1.50	1.60	1.70	1.70	1.60	1.55	1.40	1.15	1.75	1.20	1.10	2.25	4.45	3.25	3.00	2.72	2.65	1.48
February .	1.60	1.60	1.60	1.50	1.60	1.70	1.70	1.52	1.55	1.40	1.11	1.71	1.20	1.10	2.56	4.88	3.25	3.00	3.50	2.33	1.39
March....	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.30	1.55	1.40	1.12	1.70	1.18	1.10	3.10	5.25	3.25	2.91	3.63	2.04	1.39
April ..	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.27	1.55	1.40	1.21	1.68	1.15	1.15	3.56	5.88	3.25	2.65	3.75	2.10	1.48
May	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.29	1.51	1.39	1.25	1.60	1.12	1.15	3.75	6.60	3.25	2.65	3.75	2.20	1.56
June	1.69	1.60	1.60	1.60	1.60	1.70	1.62	1.25	1.48	1.35	1.25	1.45	1.10	1.16	3.63	8.00	3.25	2.65	3.55	1.95	1.63
July.....	1.75	1.60	1.60	1.60	1.60	1.70	1.60	1.33	1.41	1.35	1.30	1.45	1.10	1.22	3.44	9.00	3.25	2.65	3.38	1.85	1.70
August ..	1.75	1.60	1.60	1.60	1.60	1.70	1.60	1.40	1.40	1.34	1.35	1.44	1.18	1.26	3.70	8.80	3.25	2.65	3.25	1.78	1.88
September	1.75	1.60	1.44	1.60	1.60	1.70	1.60	1.46	1.40	1.29	1.47	1.40	1.20	1.34	4.00	8.00	3.25	2.53	3.25	1.64	2.13
October...	1.84	1.60	1.40	1.60	1.60	1.70	1.60	1.50	1.40	1.17	1.53	1.36	1.14	1.44	4.00	3.25	3.25	2.61	3.09	1.60	2.11
November.	1.82	1.60	1.40	1.60	1.62	1.70	1.60	1.54	1.40	1.13	1.59	1.26	1.08	1.65	4.15	3.25	3.25	2.65	2.81	1.54	1.99
December.	1.82	1.60	1.45	1.60	1.70	1.70	1.60	1.55	1.40	1.15	1.60	1.20	1.05	2.04	4.25	3.25	3.13	2.65	2.65	1.50	1.95
Average..	*1.70*	*1.61*	*1.54*	*1.58*	*1.61*	*1.70*	*1.64*	*1.42*	*1.47*	*1.31*	*1.33*	*1.50*	*1.14*	*1.31*	*3.53*	*5.88*	*3.24*	*2.72*	*3.28*	*1.93*	*1.72*

Beams at Pittsburgh, Cents per Pound

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January...	1.60	1.80	1.60	1.50	1.70	1.70	1.70	1.60	1.55	1.40	1.15	1.75	1.20	1.10	1.90	3.25	3.00	2.80	2.47	2.45	1.50
February..	1.60	1.60	1.60	1.50	1.70	1.70	1.70	1.52	1.51	1.40	1.11	1.71	1.20	1.10	2.05	3.25	3.00	2.80	2.70	2.26	1.39
March....	1.70	1.60	1.60	1.60	1.70	1.70	1.70	1.30	1.50	1.40	1.15	1.70	1.19	1.10	2.40	3.54	3.00	2.71	3.13	2.08	1.39
April.....	1.70	1.60	1.60	1.60	1.70	1.70	1.70	1.27	1.50	1.40	1.21	1.68	1.15	1.20	2.55	3.88	3.00	2.45	3.25	2.10	1.50
May.....	1.60	1.60	1.60	1.60	1.70	1.70	1.70	1.27	1.50	1.39	1.25	1.50	1.14	1.20	2.60	4.00	3.00	2.45	3.10	2.20	1.56
June.....	1.60	1.60	1.60	1.60	1.70	1.70	1.62	1.25	1.48	1.35	1.25	1.45	1.11	1.20	2.53	4.31	3.00	2.45	3.10	2.10	1.63
July.....	1.84	1.80	1.60	1.60	1.70	1.70	1.60	1.33	1.41	1.35	1.30	1.45	1.12	1.25	2.50	4.50	3.00	2.45	3.10	1.93	1.70
August....	2.00	1.60	1.60	1.63	1.70	1.70	1.60	1.40	1.40	1.35	1.35	1.45	1.19	1.30	2.52	4.30	3.00	2.45	3.10	1.82	1.88
September	2.00	1.60	1.44	1.70	1.70	1.70	1.60	1.46	1.40	1.34	1.42	1.41	1.20	1.35	2.64	4.00	3.00	2.45	3.10	1.64	2.00
October...	2.07	1.60	1.40	1.70	1.70	1.70	1.60	1.50	1.40	1.21	1.48	1.37	1.15	1.44	2.75	3.00	3.00	2.45	3.05	1.60	2.00
November.	2.05	1.60	1.40	1.70	1.70	1.70	1.60	1.54	1.40	1.13	1.57	1.29	1.10	1.60	2.88	3.00	3.00	2.45	2.89	1.54	2.00
December.	2.00	1.60	1.44	1.70	1.70	1.70	1.60	1.55	1.40	1.15	1.60	1.25	1.07	1.78	3.25	3.00	2.90	2.45	2.45	1.50	2.00
Average..	*1.81*	*1.62*	*1.54*	*1.62*	*1.70*	*1.70*	*1.64*	*1.42*	*1.45*	*1.32*	*1.32*	*1.50*	*1.15*	*1.39*	*2.55*	*3.67*	*2.99*	*2.53*	*2.95*	*1.94*	*1.71*

Wire Nails at Pittsburgh, Dollars per Keg of 100 Lb.

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January...	$1.99	$1.89	$1.89	$1.75	$1.85	$2.00	$2.05	$1.95	$1.85	$1.71	$1.57	$1.75	$1.54	$1.54	$2.13	$3.00	$3.50	$3.50	$4.50	$3.25	$2.50
February..	2.05	1.92	1.90	1.80	1.85	2.00	2.05	1.95	1.85	1.75	1.60	1.75	1.60	1.57	2.25	3.00	3.50	3.50	4.50	3.21	2.40
March....	2.05	2.00	1.91	1.80	1.85	2.00	2.05	1.95	1.85	1.79	1.60	1.76	1.60	1.60	2.40	3.20	3.50	3.44	4.00	3.02	2.40
April.....	2.05	2.00	1.90	1.80	1.85	2.00	2.05	1.87	1.85	1.80	1.60	1.80	1.60	1.56	2.40	3.28	3.50	3.25	4.00	3.13	2.40
May.....	2.05	2.00	1.90	1.80	1.85	2.00	2.05	1.65	1.82	1.80	1.60	1.80	1.56	1.55	2.50	3.50	3.50	3.25	4.00	3.05	2.40
June.....	2.05	2.00	1.90	1.74	1.85	2.00	1.97	1.70	1.80	1.75	1.60	1.80	1.50	1.55	2.50	3.75	3.50	3.25	4.00	3.00	2.40
July.....	2.05	2.00	1.89	1.70	1.84	2.00	1.95	1.72	1.75	1.70	1.62	1.70	1.52	1.60	2.50	4.00	3.50	3.25	4.00	2.81	2.40
August....	2.05	2.00	1.71	1.70	1.82	2.00	1.95	1.80	1.70	1.69	1.66	1.65	1.56	1.61	2.58	4.00	3.50	3.25	4.25	2.75	2.48
September	2.03	2.00	1.60	1.74	1.86	2.05	1.95	1.80	1.70	1.65	1.70	1.65	1.60	1.69	2.60	4.00	3.50	3.25	4.25	2.86	2.63
October...	1.89	2.00	1.60	1.80	1.85	2.05	1.95	1.80	1.70	1.64	1.70	1.63	1.60	1.80	2.63	.....	3.50	3.31	4.25	2.90	2.70
November.	1.85	1.97	1.62	1.80	1.88	2.05	1.95	1.80	1.70	1.55	1.70	1.59	1.50	1.87	2.85	3.50	3.50	3.50	4.05	2.84	2.70
December.	1.85	1.87	1.73	1.80	2.00	2.05	1.95	1.85	1.70	1.53	1.72	1.55	1.51	2.04	3.00	3.50	3.50	4.13	3.25	2.69	2.70
Average..	*2.00*	*1.97*	*1.79*	*1.77*	*1.86*	*2.02*	*1.99*	*1.82*	*1.77*	*1.70*	*1.64*	*1.70*	*1.56*	*1.67*	*2.53*	*3.52*	*3.50*	*3.41*	*4.09*	*2.96*	*2.51*

Steel Rails at Mill, Dollars per Gross Ton

Bessemer rails to end of 1913; open-hearth rails from beginning of 1914

The extra $2 per gross ton, which has for many years been charged for open-hearth rails, was annulled with the rail price announced Oct. 22, 1921

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January...	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$30.00	$30.00	$30.00	$40.00	$57.00	$57.00	$47.00	$47.00	$40.00
February..	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	30.00	40.00	57.00	57.00	47.00	47.00	40.00
March....	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	30.00	40.00	57.00	54.50	49.50	47.00	40.00
April.....	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	30.00	40.00	57.00	47.00	57.00	47.00	40.00
May.....	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	35.00	40.00	57.00	47.00	57.00	47.00	40.00
June.....	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	35.00	40.00	57.00	47.00	57.00	47.00	40.00
July.....	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	35.00	40.00	57.00	47.00	57.00	47.00	40.00
August....	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	35.00	40.00	57.00	47.00	57.00	47.00	40.00
September	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	35.00	40.00	57.00	47.00	57.00	47.00	40.00
October...	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	35.00	.....	57.00	47.00	57.00	45.25	43.00
November.	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	38.00	.....	57.00	47.00	57.00	40.00	43.0
December.	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	30.00	40.00	.....	57.00	47.00	53.00	40.00	43.00
Average..	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*28.00*	*30.00*	*30.00*	*34.00*	*40.00*	*57.00*	*49.29*	*54.38*	*45.69*	*40.75*

Monthly Averages of Ferromanganese Quotations

KEY TO CHART OF FERROMANGANESE PRICES

I. August 6, 1914, the first week of the World War, saw German shipments cut off and British deliveries uncertain; ferromanganese sold as high as $150 per ton spot. The average shown is for three weeks.

II. During February, 1915, "married contracts" were made by consumers of British ferromanganese holding contracts at $38 per ton, which were averaged with the new $68 quotations. Spot sales were made as high as $90 per ton.

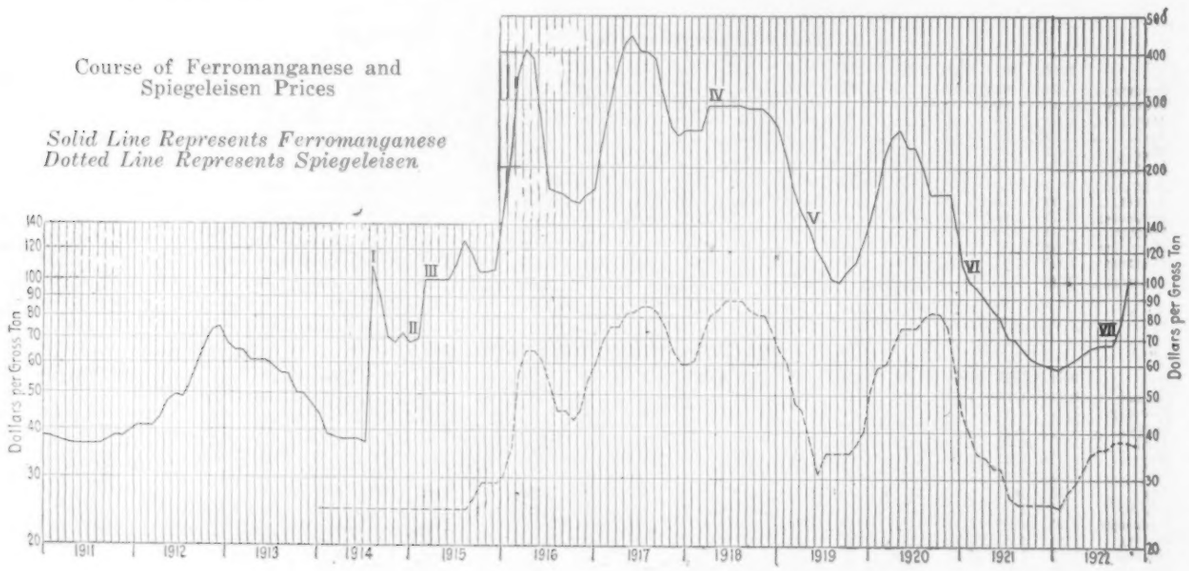
III. Hereafter quotations are based on spot domestic prices. British shipments were uncertain and prices were based on $63 per ton or so-called "married contracts."

IV. In April, 1918, the standard of ferromanganese was reduced from 80 to 70 per cent with adjustment of $4 per unit from the $250 per ton quotation. We quote 80 per cent.

V. From May 22, 1919, until November 13, 1919, we quote British ferromanganese, which dominated the market at from $5 to $10 below domestic prices.

VI. These quotations are all on a delivered basis.

VII. Tariff act beginning Sept. 22, 1922, raised prices; quotations are "duty paid."



Ferromanganese Prices in Dollars per Gross Ton, at Seaboard

	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$38.04	$41.00	$68.00	$44.40	$68.00	$150.00	$175.00	$250.00	$255.00	$146.00	$112.50	$58.35
February	37.69	41.00	65.00	39.25	69.75	207.50	231.25	250.00	215.00	172.50	100.00	60.42
March	37.10	41.00	65.00	38.50	100.00	349.60	290.00	250.00	175.00	216.25	96.00	62.50
April	36.75	43.00	61.00	38.00	100.00	406.25	362.50	290.00	150.00	240.00	90.00	64.37
May	36.50	47.50	61.00	38.00	100.00	387.50	420.50	290.00	138.40	250.00	85.00	66.87
June	36.50	49.25	61.00	38.00	100.00	270.00	443.75	290.00	121.00	225.00	80.00	67.50
July	36.50	48.88	59.00	37.20	109.00	175.00	406.25	290.00	111.00	225.00	70.60	67.50
August	36.70	52.40	56.38	108.33	127.25	172.00	400.00	290.00	101.25	198.75	70.00	67.50
September	37.75	59.63	56.00	90.00	117.00	169.75	387.50	285.00	98.75	170.00	65.80	75.63
October	38.50	67.80	50.10	70.40	105.00	162.25	310.00	285.00	105.00	170.00	63.00	100.00
November	38.40	73.75	50.00	68.00	105.00	160.80	256.00	285.00	112.50	170.00	61.50	100.00
December	39.75	75.00	47.00	72.20	106.00	169.75	243.75	275.00	122.50	135.00	60.00	100.00
Average	*37.51*	*53.35*	*58.29*	*56.86*	*105.83*	*231.70*	*327.21*	*277.50*	*142.12*	*193.21*	*79.53*	*74.22*

Wire Rod Prices at Pittsburgh for Twenty Years

No. 5 Bessemer wire rods, per gross ton. The quotations for November and December, 1917, and all of 1918, are Government prices and apply also to open-hearth rods.

	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$34 70	$30.00	$31.00	$33.75	$37.00	$34.30	$33.00	$33.00	$28.00	$24.37	$30.00	$25.50	$25.00	$43.00	$75.00	$57.00	$57.00	$60.00	$57.00	$36.00
February	35.75	30.00	31.00	34.00	37.00	35.00	33.00	33.00	28.75	25.00	30.00	26.38	25.00	48.00	77.50	57.00	57.00	63.75	54.50	35.75
March	36.62	30.80	31.70	34.00	37.00	35.00	33.00	33.00	29.00	25.00	30.00	26.50	25.00	54.80	81.00	57.00	55.75	70.00	52.00	36.00
April	37.00	31.00	34.00	34.12	37.00	35.00	29.00	32.50	29.00	25.00	30.00	26.00	25.00	60.00	85.00	57.00	52.00	70.00	49.00	38.00
May	37.00	30.50	34.00	34.40	37.00	35.00	27.50	32.00	29.00	25.00	30.00	25.50	25.00	60.00	86.00	57.00	52.00	72.50	48.00	38.00
June	36 62	29.20	33.30	34.00	37.12	33.50	27.50	30.80	28.25	25.00	29.50	24.50	25.00	53.75	92.50	57.00	52.00	75.00	48.00	38.50
July	35 80	28.00	31.87	34.00	36.50	33.00	29.40	29.25	27.00	25.00	28.30	24.50	25.63	53.75	96.25	57.00	52.00	75.00	43.00	46.00
August	35 00	28.00	32.10	34.00	36.10	33.25	31.00	28.25	27.00	25.80	28.00	25.00	27.00	55.00	94.00	57.00	52.00	75.00	41.80	42.40
September	34 75	27.00	31.12	34.00	36.00	33.00	31.50	28.00	27.00	27.00	27.37	26.20	29.40	55.00	88.75	57.00	52.00	75.00	39.50	46.25
October	34 00	26.00	31.75	34.50	35.40	33.00	31.87	28.50	26.00	28.50	26.60	25.88	31.75	55.00	77.25	57.00	52.00	75.00	40.50	45.00
November	31 62	26.75	32.10	35.50	34.00	33.00	32.50	28.12	25.30	29.75	25.87	25.25	36.25	63.00	57.00	57.00	54.50	66.40	40.00	45.00
December	30 50	29.80	32.50	37.00	34.00	33.00	33.00	28.00	24.50	30.00	25.17	25.00	39.50	68.75	57.00	57.00	59.50	57.00	38.00	45.00
Average	*34 95*	*28.92*	*32.20*	*34.44*	*36.18*	*33.84*	*31.02*	*30.37*	*27.40*	*26.29*	*28.40*	*25.52*	*28.29*	*55.84*	*79.77*	*57.00*	*53.98*	*69.55*	*45.94*	*40.49*

Hot-Rolled and Cold-Rolled Strip Steel

Quoted in cents per pound, at Pittsburgh

	COLD-ROLLED STRIP STEEL						HOT-ROLLED STRIP STEEL					
	1917	1918	1919	1920	1921	1922	1917	1918	1919	1920	1921	1922
January	7.00	6.50	6.25	6.00	6.25	3.50	....	4.50	3.30	3.45	3.30	2.00
February	7.25	6.50	6.25	7.00	6.06	3.50	....	4.50	3.30	4.63	3.11	1.84
March	7.63	6.50	6.10	7.00	5.83	3.50	....	4.50	3.30	5.00	2.93	1.81
April	7.31	6.50	5.65	7.75	5.54	3.61	....	4.50	3.30	5.25	2.76	1.96
May	7.60	6.50	5.65	8.50	4.98	3.71	....	4.25	3.30	5.50	2.53	2.20
June	8.63	6.50	5.65	8.50	4.88	4.00	....	3.50	3.05	5.50	2.50	2.40
July	9.00	6.50	5.65	8.50	4.25	4.00	....	3.50	3.05	5.50	2.46	2.50
August	9.00	6.50	5.65	8.50	3.96	4.10	....	3.50	3.31	5.50	2.23	2.60
September	9.00	6.50	5.65	8.50	3.78	4.25	....	3.50	3.30	5.50	2.00	2.75
October	9.00	6.50	5.65	8.25	3.75	4.50	....	3.50	3.30	5.25	2.00	2.90
November	6.75	6.50	5.65	8.00	3.75	4.50	4.50	3.50	3.30	4.70	2.00	2.83
December	6.50	6.35	5.93	6.63	3.75	4.50	4.50	3.50	3.30	3.65	2.00	2.75
Average	*7.89*	*6.49*	*5.81*	*7.76*	*4.73*	*3.97*	....	*3.90*	*3.26*	*4.93*	*2.49*	*2.38*

Wrought Iron and Steel Pipe Prices

Computed from discounts as per list, for carload lots; price for base size pipe, ¾ to 3-in.

Wrought Iron Pipe, per Gross Ton

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$67.20	$53.76	$49.28	$53.67	$49.28	$58.53	$67.20	$62.72	$53.76	$56.00	$56.00	$60.48	$62.72	$62.72	$72.98	$103.04	$150.08	$143.36	$140.94	$166.68	$100.96
February	67.20	53.76	49.28	54.88	49.28	67.20	67.20	57.92	53.76	56.00	56.00	60.48	62.72	62.72	77.40	105.44	150.08	143.36	146.72	166.68	100.96
March	71.90	53.76	52.95	56.00	49.28	67.20	67.20	49.28	53.76	56.00	56.00	60.48	62.72	62.72	82.09	111.42	150.08	140.58	146.72	157.92	100.96
April	73.92	53.76	53.76	56.41	49.28	67.20	67.20	49.28	53.76	56.00	56.00	60.48	62.72	62.72	86.61	125.01	150.08	135.52	146.72	152.54	100.96
May	73.92	53.76	53.76	57.12	49.28	67.20	67.20	49.28	53.76	56.00	56.00	60.48	62.72	64.96	89.60	138.88	150.08	135.52	146.72	144.48	100.96
June	73.92	53.76	51.52	57.12	49.28	70.34	64.06	49.28	53.76	56.00	56.00	62.65	62.72	64.96	89.60	138.88	150.08	135.52	146.72	144.48	100.96
July	72.92	53.76	51.12	57.12	49.28	71.68	62.72	49.28	53.76	56.00	56.00	62.72	62.72	64.96	89.60	149.72	150.08	135.52	146.72	137.01	100.96
August	73.92	53.76	51.12	57.12	49.28	71.68	62.72	53.33	53.76	56.00	56.00	62.72	62.72	64.96	89.60	150.08	150.08	135.52	146.72	135.52	102.81
September	73.92	53.76	51.12	57.12	49.28	71.68	62.72	53.76	53.76	56.00	58.17	62.72	62.72	64.96	91.39	150.08	150.08	135.52	146.72	124.32	115.32
October	73.92	53.76	51.12	49.54	52.17	70.38	62.72	53.76	56.00	56.00	58.24	62.72	62.72	64.96	91.84	150.08	150.08	135.52	146.72	124.32	120.41
November	61.15	53.76	51.12	49.28	53.76	67.20	62.72	53.76	56.00	56.00	60.48	62.72	62.72	67.20	93.03	150.08	150.08	135.52	146.72	124.32	120.41
December	53.76	53.62	51.12	49.28	55.06	67.20	62.72	53.76	56.00	56.00	60.48	62.72	62.72	67.20	98.42	150.08	150.08	135.52	157.78	124.32	120.41
Average	*69.89*	*53.75*	*51.44*	*54.56*	*50.39*	*68.46*	*64.70*	*52.95*	*54.32*	*56.00*	*57.11*	*61.63*	*62.72*	*64.59*	*87.68*	*136.90*	*150.08*	*137.25*	*147.16*	*141.88*	*107.17*

Steel Pipe, per Gross Ton

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$67.20	$56.00	$51.52	$51.70	$47.04	$56.58	$62.72	$58.24	$49.28	$44.80	$40.32	$44.80	$44.80	$42.56	$52.17	$80.64	$109.76	$103.04	$95.20	$95.20	$51.87
February	67.20	56.00	53.76	53.76	47.04	58.24	62.72	54.24	49.28	44.80	40.32	44.80	45.88	44.16	55.00	83.04	109.76	103.04	95.20	95.20	51.87
March	71.80	56.00	56.00	54.88	47.04	60.84	62.72	47.04	49.28	44.80	40.32	44.80	45.92	44.80	59.69	89.02	109.76	100.51	95.20	95.20	51.87
April	73.92	56.00	56.00	55.29	47.04	62.72	62.72	47.04	49.28	44.80	40.32	45.51	45.51	44.80	64.21	100.43	109.76	95.20	95.20	88.48	51.87
May	73.92	56.00	56.00	56.00	47.04	62.72	62.72	47.04	49.28	44.80	40.32	46.10	44.80	47.04	67.20	100.80	109.76	95.20	95.20	84.00	51.87
June	73.92	56.00	53.76	56.00	47.04	62.72	59.58	47.04	49.28	44.80	42.56	47.04	44.80	47.04	67.20	100.80	109.76	95.20	95.20	84.00	51.87
July	73.92	56.00	48.16	56.00	47.04	62.72	58.24	47.04	49.28	44.80	43.14	47.04	44.80	47.04	67.20	100.80	109.76	95.20	95.20	80.39	51.87
August	73.92	56.00	48.16	56.00	47.04	62.72	58.24	47.04	49.28	44.80	44.80	45.31	44.80	47.04	67.20	100.80	109.76	95.20	95.20	79.52	52.98
September	73.92	56.00	47.11	56.00	47.04	62.72	58.24	47.04	49.28	44.80	46.37	44.80	44.80	47.04	68.99	100.80	109.76	95.20	95.20	75.04	57.43
October	73.92	56.00	47.98	47.33	49.93	62.72	58.24	49.28	44.80	42.63	47.04	44.80	44.80	47.04	69.44	100.80	109.76	95.20	95.20	70.56	58.91
November	62.55	56.00	51.52	47.04	51.52	62.72	58.24	49.28	44.80	42.56	47.04	44.80	42.63	49.28	70.63	108.27	109.76	95.20	95.20	70.56	61.13
December	56.00	56.00	51.52	47.04	54.41	62.72	58.24	49.28	44.80	40.32	47.04	44.80	42.56	49.28	76.45	109.76	105.64	95.20	95.20	67.49	61.13
Average	*70.18*	*56.00*	*51.79*	*53.09*	*48.33*	*61.68*	*60.22*	*49.13*	*48.16*	*44.06*	*43.30*	*45.38*	*44.68*	*46.43*	*65.45*	*98.00*	*109.42*	*96.95*	*95.20*	*82.14*	*54.56*

Cast Iron Pipe Prices, 1902 to 1922

At New York, 6-Inch, per Net Ton

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$24.50	$29.25	$24.50	$28.00	$29.75	$34.25	$27.00	$24.50	$25.50	$22.00	$22.00	$25.00	$22.00	$20.00	$29.00	$41.50	$55.35	$65.70	$66.30	$63.30	$47.30
February	25.00	29.25	24.25	28.50	29.50	34.25	26.75	24.25	25.50	21.50	22.00	24.75	22.00	20.00	29.33	41.50	55.35	62.70	70.30	63.30	47.30
March	26.25	30.75	24.25	26.75	30.50	34.00	26.25	25.25	25.50	21.00	22.00	23.87	22.00	20.00	29.75	43.10	55.35	62.70	71.30	63.30	47.68
April	26.00	31.00	24.25	27.00	29.75	33.50	26.25	25.00	25.50	21.00	21.25	23.50	22.00	21.60	30.50	50.88	55.35	57.70	73.90	63.30	48.80
May	27.75	30.75	24.00	27.25	31.00	34.25	26.25	25.25	25.50	21.00	21.00	23.00	20.88	22.00	30.50	55.50	56.60	54.45	76.30	62.05	49.60
June	28.00	30.75	23.50	27.25	32.50	33.50	25.75	26.00	25.25	21.00	21.00	23.00	20.50	22.25	30.50	60.75	61.44	52.03	76.30	54.30	50.80
July	28.50	30.75	23.50	27.25	30.25	34.00	25.75	26.25	24.00	21.00	22.10	23.00	20.50	22.50	30.50	65.50	61.75	50.46	76.30	52.30	53.50
August	29.50	29.50	23.50	27.75	30.50	32.50	25.25	26.00	23.50	21.00	22.00	23.00	20.50	23.25	30.50	65.50	61.75	52.33	76.53	46.05	54.10
September	29.50	29.00	23.00	27.25	31.00	33.00	25.75	25.75	23.50	21.00	23.12	23.00	20.40	24.37	30.83	65.50	61.75	54.30	77.22	46.30	54.50
October	29.50	26.00	23.25	28.25	33.00	33.50	25.75	25.50	23.00	21.00	24.50	23.00	20.00	25.25	31.50	61.00	67.70	55.30	77.22	47.30	54.50
November	30.75	24.50	25.00	29.00	33.25	28.50	25.00	25.87	22.12	21.40	24.12	23.00	20.00	26.50	35.50	56.50	67.70	58.30	77.22	47.30	54.50
December	29.25	24.25	27.00	29.25	35.50	28.00	25.50	25.70	22.00	22.00	24.62	22.33	20.00	27.60	41.00	56.50	67.70	61.30	68.87	47.30	54.75
Average	*27.88*	*28.81*	*24.17*	*27.79*	*31.38*	*32.77*	*25.94*	*25.44*	*24.24*	*21.24*	*22.48*	*23.37*	*20.90*	*22.94*	*31.62*	*55.31*	*60.65*	*57.27*	*73.98*	*54.68*	*51.44*

Prices of Spiegeleisen, 1914 to 1922

Dollars per Gross Ton at Furnace

	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$25.00	$25.00	$30.38	$60.00	$60.00	$66.00	$51.40	$45.00	$26.00
February	25.00	25.00	36.25	68.75	61.25	60.75	58.75	40.00	28.00
March	25.00	25.00	57.00	75.00	71.25	47.00	60.00	35.00	29.40
April	25.00	25.00	65.60	75.00	80.75	45.00	67.60	34.00	32.25
May	25.00	25.00	65.00	81.00	84.00	37.40	75.00	32.00	35.00
June	25.00	25.00	61.00	82.50	89.00	31.25	75.00	32.00	36.00
July	25.00	25.00	52.50	85.00	89.00	35.00	75.00	27.00	36.00
August	25.00	25.00	45.00	85.00	89.00	35.00	80.00	26.00	37.80
September	25.00	26.60	45.00	82.50	83.75	35.00	82.00	26.00	38.25
October	25.00	29.25	42.75	76.25	82.00	35.00	81.88	26.00	38.00
November	25.00	29.25	45.40	66.00	80.25	37.00	75.62	26.00	37.50
December	25.00	29.25	55.00	60.00	74.38	40.00	59.10	26.00	37.50
Average	*25.00*	*26.20*	*50.02*	*74.75*	*78.72*	*42.03*	*70.11*	*31.25*	*34.31*

Connellsville Coke Prices for Twenty Years

We present below tables showing monthly prices of prompt shipment Connellsville furnace and foundry coke for 20 years, 1903 to 1922, inclusive, averaged from weekly quotations in THE IRON AGE.

Average Prices of Prompt Connellsville Furnace Coke, per Net Ton at Oven

	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$5.00	$1.60	$2.46	$2.62	$3.53	$1.92	$1.59	$2.55	$1.40	$1.82	$3.88	$1.85	$1.50	$2.94	$9.50	$6.00	$5.65	$6.00	$5.06	$2.75
February	5.00	1.52	2.56	2.14	3.50	1.86	1.59	2.12	1.45	1.78	2.52	1.85	1.50	3.38	9.62	6.00	4.44	6.00	4.50	3.04
March	5.00	1.65	2.43	2.24	3.02	1.72	1.60	2.00	1.55	2.12	2.40	1.90	1.50	3.47	9.60	6.00	4.06	6.00	4.35	3.25
April	4.20	1.60	2.07	2.45	2.72	1.57	1.60	1.77	1.59	2.39	2.15	1.86	1.50	2.41	7.38	6.00	3.65	9.60	3.50	4.48
May	3.50	1.50	1.87	2.46	2.16	1.50	1.57	1.66	1.50	2.28	2.13	1.77	1.50	2.30	7.80	6.00	3.69	12.00	3.25	6.00
June	3.00	1.45	1.82	2.32	1.89	1.55	1.52	1.65	1.42	2.02	2.11	1.75	1.56	2.49	11.25	6.00	4.00	15.00	3.00	6.75
July	2.50	1.45	1.81	2.51	2.40	1.57	1.58	1.59	1.44	2.21	2.45	1.75	1.64	2.75	12.75	6.00	4.07	17.20	2.81	10.75
August	2.25	1.45	1.80	2.76	2.62	1.50	1.66	1.57	1.46	2.21	2.50	1.70	1.50	2.80	13.60	6.00	4.31	17.75	2.75	12.80
September	2.20	1.45	2.10	2.85	2.82	1.50	2.39	1.60	1.50	2.37	2.29	1.65	1.61	2.94	11.12	6.00	4.56	16.70	3.15	11.13
October	1.90	1.47	2.61	2.84	2.85	1.53	2.76	1.59	1.50	3.41	2.98	1.60	2.03	4.86	6.00	6.00	4.52	15.12	3.28	9.60
November	1.75	2.04	2.95	3.13	2.41	1.72	2.74	1.50	1.53	3.94	1.83	1.53	2.28	6.90	6.00	6.00	5.87	8.26	3.03	7.19
December	1.62	2.12	2.79	3.52	2.06	1.82	2.67	1.44	1.60	4.00	1.75	1.50	2.64	8.38	6.00	6.00	6.12	6.20	2.75	7.00
Average	*3.16*	*1.61*	*2.27*	*2.65*	*2.67*	*1.65*	*1.94*	*1.75*	*1.49*	*2.55*	*2.42*	*1.73*	*1.73*	*3.80*	*9.22*	*6.00*	*4.58*	*11.32*	*3.45*	*7.06*

Average Prices of Prompt Connellsville Foundry Coke, per Net Ton at Oven

	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$6.50	$2.18	$2.38	$3.42	$4.25	$2.45	$2.00	$2.90	$1.90	$1.97	$4.40	$3.50	$2.00	$5.50	$9.75	$7.00	$6.25	$7.00	$6.28	$3.75
February	6.50	2.10	2.68	2.65	4.00	2.39	1.95	2.70	2.10	2.09	3.25	2.50	2.00	3.50	11.00	7.00	5.00	7.00	5.63	4.00
March	6.50	2.25	2.75	2.78	3.65	2.25	1.95	2.60	2.05	2.56	3.60	2.45	2.00	3.75	11.60	7.00	4.94	7.00	5.45	4.25
April	5.50	2.15	2.70	2.95	3.31	2.22	1.86	2.45	2.00	2.69	3.00	2.40	2.00	3.56	9.13	7.00	4.30	10.20	4.75	5.06
May	4.50	2.00	2.55	2.81	3.00	2.03	1.85	2.20	1.81	2.58	2.85	2.40	2.00	3.25	8.90	7.00	4.31	13.00	4.50	6.30
June	3.50	1.90	2.40	2.65	3.00	2.00	1.80	2.17	1.76	2.40	2.80	2.32	2.00	3.25	11.73	7.00	4.56	15.75	4.45	7.25
July	3.25	1.80	2.35	2.79	3.00	2.00	2.00	2.15	1.82	2.40	2.70	2.22	2.05	3.25	13.25	7.00	5.00	17.80	4.06	11.00
August	3.00	1.75	2.25	3.00	3.08	1.92	1.95	2.15	1.85	2.40	2.90	2.25	2.00	3.30	13.20	7.00	5.25	18.88	3.75	13.90
September	2.87	1.85	2.50	3.19	3.20	1.90	2.53	2.12	1.85	2.54	2.90	2.10	2.07	3.31	11.75	7.00	5.80	17.70	4.15	12.50
October	2.87	2.00	3.00	3.31	3.25	2.10	2.90	2.10	1.81	3.65	2.81	2.00	2.35	3.88	6.00	7.00	6.25	16.38	4.28	11.70
November	2.50	2.25	3.50	4.00	2.75	2.20	3.25	2.05	1.85	4.25	2.60	1.92	2.88	7.10	7.00	7.00	7.00	9.50	4.19	8.38
December	2.25	2.35	3.50	4.12	2.50	2.25	3.20	1.97	1.90	4.50	2.50	1.90	2.95	8.63	7.00	7.00	7.00	7.00	3.81	7.88
Average	*4.15*	*2.05*	*2.71*	*3.14*	*3.25*	*2.14*	*2.27*	*2.30*	*1.89*	*2.84*	*2.98*	*2.25*	*2.19*	*4.19*	*10.05*	*7.00*	*5.47*	*12.27*	*4.63*	*8.00*

Scrap Prices at Chicago, 1905 to 1922

Heavy Melting Steel Scrap, per Gross Ton

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$14.88	$14.95	$16.80	$11.05	$13.94	$16.00	$11.75	$10.75	$12.60	$ 9.35	$9.19	$15.50	$21.12	$30.00	$17.40	$24.50	$15.13	$11.45
February	14.13	13.63	15.75	12.50	13.56	15.50	12.06	10.75	12.13	10.50	9.56	14.75	21.50	30.25	15.06	25.00	15.13	11.38
March	14.45	13.00	16.00	11.44	12.13	15.00	12.15	10.94	12.08	9.81	9.63	16.50	23.70	29.87	15.63	24.25	12.50	12.88
April	14.38	13.50	15.75	11.05	12.35	14.44	11.75	11.56	12.50	9.80	9.15	16.50	27.00	28.75	16.41	23.75	11.00	13.75
May	12.55	13.70	15.60	10.62	13.44	13.56	10.50	12.05	11.25	9.69	9.37	15.94	28.70	28.80	15.62	23.00	11.50	14.95
June	11.95	13.13	16.25	11.62	14.50	13.15	10.38	12.12	10.44	9.75	9.44	14.80	36.50	29.00	16.69	22.95	10.81	14.56
July	12.75	13.13	16.12	11.75	14.06	12.38	10.69	11.69	10.50	9.75	10.40	14.50	33.00	29.00	19.40	24.13	10.00	15.25
August	13.15	14.10	15.10	12.88	15.00	12.25	11.05	12.25	10.56	9.69	11.56	15.25	29.60	29.00	20.88	25.35	10.60	15.95
September	14.38	16.50	14.75	13.00	16.00	12.25	10.70	12.81	10.06	9.19	11.75	16.06	31.25	29.00	19.10	24.81	11.31	18.13
October	14.50	16.60	14.70	13.45	16.43	12.25	10.00	13.95	10.00	8.50	11.75	16.81	26.00	29.00	18.25	21.50	12.44	18.40
November	15.20	17.50	12.63	14.88	16.00	12.25	9.75	13.69	9.56	8.06	13.44	20.60	27.60	28.50	20.88	18.45	12.25	17.31
December	15.25	17.13	11.50	15.17	16.00	12.10	10.25	12.88	9.00	8.43	15.63	23.00	28.37	22.75	21.80	16.20	11.13	17.25
Average	*13.96*	*14.74*	*15.08*	*12.45*	*14.45*	*13.43*	*10.92*	*12.12*	*10.89*	*9.38*	*10.91*	*16.68*	*27.86*	*28.66*	*18.09*	*22.82*	*11.98*	*15.06*

Old Steel Rerolling Rails, per Gross Ton

January	$16.00	$16.50	$19.00	$12.30	$15.81	$18.00	$13.69	$13.00	$16.15	$11.10	$ 9.62	$17.06	$27.00	$35.00	$22.10	$34.25	$15.63	$12.10
February	15.13	16.25	19.00	13.00	15.12	18.00	13.63	12.80	15.50	11.81	9.87	17.06	27.00	35.00	16.44	34.38	15.50	12.00
March	15.30	15.70	19.00	12.19	13.06	17.80	13.65	12.75	15.00	11.56	10.25	17.65	28.00	34.75	16.38	32.30	13.30	13.31
April	15.44	15.75	18.50	12.60	13.20	17.69	13.44	12.88	14.63	11.50	10.25	18.00	32.62	33.50	17.55	32.13	12.63	14.50
May	14.06	16.00	18.60	12.94	14.44	17.12	13.49	13.50	13.95	11.31	10.25	17.38	36.50	34.00	17.75	31.75	13.40	15.70
June	12.95	15.88	18.94	13.94	15.50	16.50	12.38	13.50	12.69	11.50	10.25	15.85	46.90	34.00	18.75	32.65	12.94	15.25
July	13.56	15.50	18.00	14.50	15.40	15.88	12.25	13.50	12.25	11.50	10.30	15.25	45.19	34.00	25.15	35.00	12.25	16.13
August	14.35	15.90	17.00	15.63	16.12	15.31	12.65	14.00	12.12	11.50	12.25	15.80	39.20	34.00	29.50	38.00	12.45	16.90
September	15.25	17.63	16.75	16.18	17.15	15.25	12.75	15.00	12.25	10.75	13.35	17.06	39.75	34.00	26.80	38.13	13.13	19.38
October	15.63	18.63	17.15	15.80	18.00	15.25	12.44	16.30	12.15	10.00	13.31	18.81	34.75	34.00	27.19	33.44	14.00	20.30
November	16.30	21.15	15.06	17.19	18.00	15.06	12.30	16.50	12.00	9.50	14.44	24.50	34.80	33.50	31.25	22.90	13.80	18.38
December	16.50	21.00	12.94	16.95	18.00	14.20	12.50	16.50	11.33	9.50	16.63	28.63	35.25	27.50	31.90	16.90	12.63	17.75
Average	*15.04*	*17.16*	*17.50*	*14.44*	*15.82*	*16.34*	*12.93*	*14.19*	*13.34*	*10.96*	*11.73*	*19.59*	*35.58*	*33.60*	*23.40*	*31.90*	*13.47*	*15.98*

No. 1 Railroad Wrought, per Net Ton

January	$18.19	$17.30	$16.35	$11.20	$13.81	$14.88	$11.75	$11.63	$12.70	$8.70	$8.69	$15.88	$23.50	$31.25	$19.10	$26.00	$13.63	$10.50
February	17.00	15.88	15.50	12.44	12.88	14.69	12.00	11.30	12.19	9.50	8.87	14.94	23.75	31.25	15.13	27.00	13.50	10.44
March	16.40	14.88	15.25	11.25	11.43	14.45	12.30	11.44	12.13	9.06	9.00	16.20	25.90	30.75	15.88	27.10	11.60	11.50
April	16.06	14.50	15.25	11.00	11.90	14.19	11.69	12.31	12.38	9.00	8.65	17.00	30.35	30.20	16.05	27.25	10.00	12.13
May	14.19	14.50	15.45	10.75	12.81	12.87	11.38	12.75	11.25	9.00	8.94	16.50	32.60	29.75	15.69	26.38	10.40	12.90
June	13.50	13.50	16.06	11.69	13.38	12.75	11.25	12.57	10.56	9.00	9.00	15.20	41.00	29.75	16.87	25.25	9.63	12.69
July	14.13	13.50	15.06	12.15	13.16	12.44	11.00	12.06	10.55	9.00	9.15	14.94	37.75	29.75	18.60	24.88	9.25	13.63
August	15.45	14.50	14.40	12.69	14.44	11.94	11.10	12.50	10.62	8.94	10.44	15.30	33.70	29.75	20.75	24.75	10.45	14.75
September	16.31	16.13	14.38	13.44	15.35	11.94	10.94	13.13	10.19	8.37	11.00	16.38	35.50	29.75	19.50	23.88	11.50	17.62
October	17.00	17.50	14.60	13.60	15.94	11.75	10.44	14.25	9.60	7.87	11.19	17.50	28.75	30.36	19.38	20.25	13.00	17.75
November	17.50	18.00	12.32	14.38	15.31	11.94	10.20	13.50	9.00	7.56	12.94	21.00	30.90	28.68	22.88	16.85	12.20	16.81
December	18.00	17.25	11.00	14.83	14.75	11.65	10.75	13.06	8.50	7.90	15.38	25.13	31.25	24.62	24.10	14.60	10.44	15.13
Average	*16.14*	*15.62*	*14.64*	*12.45*	*13.76*	*12.96*	*11.23*	*12.54*	*10.81*	*8.66*	*10.27*	*17.16*	*31.25*	*29.66*	*18.66*	*23.68*	*11.30*	*13.74*

No. 1 Cast Scrap, per Net Ton

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$13.81	$14.70	$17.80	$12.95	$13.06	$14.88	$12.19	$11.25	$12.90	$10.20	$9.19	$13.31	$15.50	$25.90	$22.95	$37.25	$17.25	$12.90
February	13.13	13.50	18.25	13.00	12.75	14.88	12.13	11.25	12.69	10.87	9.00	12.81	15.37	26.06	20.00	38.88	18.00	13.25
March	13.40	12.75	19.50	12.12	12.19	14.50	12.25	11.31	12.50	10.37	9.00	13.45	16.90	27.25	21.63	37.85	14.90	14.13
April	13.81	12.94	18.88	12.05	12.60	13.69	11.81	12.06	12.44	10.25	9.00	12.88	20.43	27.12	21.45	37.25	13.25	14.88
May	12.50	13.40	18.55	11.50	13.31	13.13	11.00	12.20	11.60	10.06	9.00	12.56	23.20	26.70	20.12	37.38	13.60	16.20
June	12.40	13.50	18.94	12.00	13.81	13.00	10.75	11.81	10.63	9.75	9.00	11.75	30.00	27.12	20.75	36.30	12.75	16.06
July	13.38	13.50	18.44	12.15	13.44	13.00	10.50	11.75	10.70	9.65	9.25	11.50	29.25	28.06	23.30	36.50	12.25	17.00
August	13.20	14.00	16.75	12.75	14.06	12.75	10.55	12.15	10.87	9.50	9.62	11.50	24.20	29.10	24.50	36.20	12.60	18.60
September	13.38	15.38	16.81	12.88	14.75	12.75	10.10	12.81	10.62	9.19	10.10	12.13	23.75	30.00	24.20	34.00	13.44	21.38
October	13.63	15.90	16.25	13.25	15.63	12.50	10.25	14.20	10.40	9.00	10.50	13.50	20.50	30.36	25.00	28.75	13.88	20.80
November	14.30	17.50	14.00	13.75	15.12	12.50	10.35	13.50	10.06	8.56	12.13	15.55	22.00	28.87	28.12	23.00	13.50	20.25
December	15.00	17.50	13.00	13.92	14.75	12.30	11.00	13.25	9.83	9.00	13.75	16.25	23.50	25.75	32.35	18.70	12.63	19.75
Average	*13.50*	*14.55*	*17.26*	*12.69*	*13.79*	*13.32*	*11.07*	*12.30*	*11.27*	*9.70*	*9.96*	*13.10*	*22.05*	*27.69*	*23.70*	*33.51*	*14.00*	*17.10*

Cast Borings, Per Net Ton

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$6.95	$4.15	$4.63	$7.75	$9.00	$16.50	$11.20	$14.38	$9.75	$5.70
February	6.50	5.37	4.75	7.38	9.06	16.50	7.81	14.63	10.50	6.19
March	6.63	4.69	4.75	7.40	9.50	16.50	9.06	14.05	7.50	7.19
April	6.69	4.50	4.80	7.00	10.56	16.06	9.35	14.25	6.50	8.25
May	5.55	4.50	5.00	6.75	12.00	15.65	8.31	12.88	5.90	9.80
June	4.81	4.50	5.00	5.75	17.50	15.87	9.31	11.95	5.00	10.38
July	4.80	4.50	5.15	5.69	17.87	16.50	11.35	12.63	4.75	11.31
August	5.00	4.50	5.75	6.05	16.40	16.50	12.75	13.45	4.80	11.50
September	4.69	4.75	6.40	6.50	16.25	16.50	12.10	13.08	5.00	12.88
October	4.50	4.75	6.50	6.81	14.06	16.50	10.38	11.50	5.75	13.30
November	4.31	4.56	6.56	7.50	15.40	15.00	11.50	10.65	6.10	13.00
December	3.91	4.50	7.55	9.19	16.12	13.25	12.65	9.80	5.44	13.00
Average	*5.36*	*4.61*	*5.57*	*6.98*	*13.64*	*15.94*	*10.48*	*12.77*	*6.42*	*10.21*

Railroad Malleable Scrap, per Net Ton

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$14.06	$15.00	$17.20	$10.40	$12.88	$15.00	$10.94	$10.88	$13.40	$9.25	$8.13	$13.81	$17.75	$26.80	$17.60	$29.00	$14.75	$11.40
February	13.69	14.25	16.00	11.31	12.38	14.69	10.50	10.30	13.00	10.38	8.00	13.33	17.31	26.80	14.87	29.94	15.50	11.44
March	13.44	13.00	16.25	10.00	11.50	14.50	11.00	10.44	13.00	9.56	7.94	13.95	17.95	27.89	16.13	28.50	13.80	12.38
April	13.25	13.38	16.38	10.10	11.25	13.69	11.00	11.19	13.19	9.15	8.00	13.89	20.37	28.25	15.80	27.63	12.13	14.00
May	12.38	13.50	16.25	9.81	12.38	12.94	10.38	11.55	12.10	9.13	8.14	13.44	23.30	29.30	15.25	26.50	12.60	15.00
June	11.90	13.50	17.50	10.25	12.94	12.20	10.10	11.75	11.06	9.00	8.13	11.73	31.62	29.50	16.00	25.65	11.50	14.94
July	12.31	13.38	16.75	11.40	12.75	11.25	10.00	11.75	10.60	9.00	8.90	11.63	30.12	29.71	18.70	27.00	11.19	15.63
August	13.15	13.60	16.00	12.06	13.69	11.00	10.05	12.05	10.38	8.88	10.00	11.25	29.70	30.36	20.50	28.75	12.00	17.00
September	14.19	15.00	16.00	12.38	15.15	11.20	10.00	12.56	10.19	8.25	10.25	11.50	30.75	30.36	18.95	27.63	13.06	21.13
October	14.25	15.13	16.20	12.45	15.25	11.00	9.69	13.75	9.65	7.90	10.25	13.38	25.25	30.36	19.06	23.50	13.50	21.80
November	14.55	17.30	12.25	13.44	15.13	11.25	9.50	13.56	9.31	7.75	11.38	16.00	25.60	29.18	23.12	19.45	13.10	20.63
December	15.00	18.00	10.50	13.70	14.95	11.25	10.06	13.50	9.00	7.95	13.75	18.00	27.35	22.75	25.70	15.00	11.44	20.00
Average	*13.51*	*14.59*	*15.61*	*11.44*	*13.35*	*12.50*	*10.27*	*11.94*	*11.24*	*8.85*	*9.41*	*13.41*	*24.76*	*28.44*	*18.47*	*25.71*	*12.88*	*16.28*

Old Cast Iron Carwheels, per Gross Ton

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$16.56	$19.00	$24.90	$20.10	$15.75	$18.38	$13.00	$13.25	$16.95	$11.65	$9.94	$14.63	$18.87	$30.00	$25.90	$36.13	$21.00	$15.30
February	16.38	19.00	23.50	16.94	15.25	17.88	13.00	13.05	16.75	12.44	10.00	13.94	18.25	30.00	22.75	38.06	20.63	15.00
March	15.75	18.60	23.88	15.50	14.69	17.00	13.25	13.00	16.75	11.88	9.94	14.30	20.25	30.00	21.50	36.20	15.90	16.50
April	15.88	18.75	25.00	14.00	14.50	16.50	13.25	13.25	16.75	11.55	9.75	13.88	23.62	29.00	21.50	37.50	14.06	18.63
May	14.81	19.00	25.20	12.88	14.81	15.75	12.75	13.90	15.05	11.50	9.75	12.95	27.35	29.00	21.25	37.50	14.70	18.50
June	14.25	18.00	25.38	13.00	15.81	15.50	12.55	14.13	13.94	11.50	10.19	12.44	39.00	29.00	22.00	35.90	13.31	18.25
July	14.38	18.00	24.25	13.30	16.00	14.81	12.50	13.88	12.90	11.25	11.30	12.50	35.25	29.00	23.95	35.75	12.75	19.25
August	14.95	18.50	24.50	15.50	16.25	14.50	12.85	13.70	12.75	11.25	11.04	11.60	30.40	29.00	26.25	38.35	12.95	20.60
September	15.75	19.75	24.50	15.50	18.05	14.00	12.81	14.38	12.63	11.06	11.80	11.69	31.87	29.00	24.90	37.69	14.19	23.75
October	16.00	19.31	24.38	15.25	18.31	14.00	12.50	16.00	12.10	10.65	12.00	12.94	25.75	29.00	24.88	36.06	16.50	25.10
November	17.10	22.60	23.13	15.50	18.50	13.50	12.10	16.69	12.00	9.81	13.31	17.30	28.15	29.00	28.63	31.95	16.60	24.63
December	18.75	25.00	22.00	16.00	18.50	13.50	13.06	16.75	11.88	9.60	14.56	21.25	31.00	26.75	31.10	24.40	15.75	24.00
Average	*15.88*	*19.63*	*24.22*	*15.29*	*16.37*	*15.44*	*12.80*	*14.33*	*14.20*	*11.13*	*11.13*	*14.12*	*27.48*	*29.06*	*24.55*	*35.46*	*15.70*	*19.96*

Philadelphia Scrap Prices, 1902 to 1922

These Prices, Delivered Eastern Pennsylvania, Are Averaged from Weekly Quotations in THE IRON AGE

Heavy Melting Steel Scrap, per Gross Ton

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$18.30	$20.00	$11.56	$17.44	$17.33	$18.61	$11.70	$16.94	$17.00	$12.50	$12.19	$14.40	$10.40	$10.00	$16.38	$21.70	$30.00	$17.20	$24.75	$14.50	$11.60
February	19.00	20.19	12.56	17.37	16.62	18.69	14.25	15.58	16.62	13.50	11.70	12.87	11.00	10.00	16.50	20.63	30.00	14.75	25.62	14.25	12.00
March	20.12	20 75	14.00	17.62	15.80	18.87	13.12	13.50	16.50	14.05	11.80	13.25	11.31	10.80	16.90	23.50	29.00	14.19	25.20	13.00	12.78
April	20.87	20.75	14.69	17.56	16.69	18.75	12.75	13.25	16.12	13.31	12.94	13.34	10.95	11.00	17.88	24.88	28.00	15.50	24.12	11.25	14.00
May	21.00	20 56	12.50	15.94	16.30	18.95	12.81	14.75	14.75	13.00	13.50	12.10	10.63	11.25	16.60	25.40	29.00	15.00	23.37	11.80	14.75
June	20.94	20.50	11.35	14.55	15.75	18.75	13.25	15.81	14.45	13.00	13.50	11.75	10.50	11.10	15.31	34.13	29.00	16.12	22.60	11.25	15.00
July	21.00	19.00	11.12	15.16	15.87	17.62	13.80	15.80	14.12	13.19	13.50	11.35	10.30	12.06	14.94	35.20	29.00	18.90	22.62	11.00	15.00
August	20.50	17.37	11.75	15.55	16.75	16.85	14.50	16.87	13.75	13.15	13.65	11.43	10.19	13.75	14.75	31.88	29.00	19.37	25.00	11.40	15.20
September	20.50	15.87	11.90	15.69	17.94	16.50	15.19	17.40	13.85	12.50	14.50	11.62	10.69	15.00	14.75	30.25	29.00	18.62	25.62	11.50	16.88
October	20.55	13.85	12.87	16.56	18.12	15.35	15.00	18.00	13.81	11.94	15.10	11.15	9.95	14.75	15.63	25.00	29.00	19.10	22.75	12.06	17.80
November	20.50	11.87	14.75	17.55	18.70	12.94	15.75	18.00	13.50	11.55	15.50	10.19	9.25	14.65	20.13	26.00	28.00	20.62	19.00	11.88	16.25
December	20.25	11.25	16.20	17.50	19.50	11.50	17.10	17.50	12.65	12.08	15.25	10.00	9.40	15.81	23.75	28.20	25.00	22.50	15.25	11.50	16.38
Average	*20.29*	*17.66*	*12.94*	*16.54*	*17.11*	*16.95*	*14.10*	*16.12*	*14.76*	*12.81*	*13.69*	*11.96*	*10.38*	*12.51*	*16.96*	*27.23*	*28.67*	*17.66*	*22.99*	*12.12*	*14.80*

No. 1 Machinery Cast Scrap, per Gross Ton

January	$14.40	$19.75	$12.75	$16.00	$16.00	$21.70	$15.30	$15.87	$17.00	$14.00	$13.42	$14.50	$12.00	$12.00	$17.00	$20.20	$30.00	$23.80	$36.00	$23.25	$16.50
February	14.81	19.81	12.81	15.62	15.87	22.00	15.00	15.00	16.12	14.38	13.00	14.37	12.88	12.00	17.00	20.00	30.00	23.00	40.00	23.00	16.50
March	16.00	20.00	13.30	15.75	15.50	22.25	15.00	14.00	16.00	14.40	13.12	14.00	13.00	12.00	17.00	21.75	30.00	21.25	39.20	19.40	17.13
April	17.06	20.00	13.37	16.00	15.50	21.25	15.00	14.10	15.87	13.44	13.62	13.94	13.00	11.75	17.88	26.63	29.00	22.00	38.00	18.00	17.25
May	17.70	19.25	12.50	15.19	15.40	20.80	14.87	14.69	15.06	13.13	13.75	13.60	12.25	12.13	17.50	29.00	29.00	21.50	37.75	18.00	18.40
June	18.25	18.37	11.60	14.20	15.37	20.75	14.25	15.00	15.00	13.00	13.75	13.25	12.00	12.25	16.50	33.50	29.00	22.00	37.00	17.38	19.00
July	17.75	17.50	11.25	14.00	15.12	19.25	14.00	14.85	14.94	13.06	13.75	13.00	12.00	12.38	16.00	36.30	29.00	22.10	37.50	16.50	17.50
August	18.25	15.87	11.50	14.40	16.30	18.60	14.25	15.37	14.25	13.20	13.75	12.87	12.00	13.30	16.00	33.25	29.00	24.75	39.00	17.00	18.60
September	19.00	14.75	11.50	15.12	17.44	18.00	15.25	15.90	14.00	12.69	14.96	12.81	12.00	14.00	16.00	31.00	29.00	25.00	39.25	17.00	21.50
October	19.50	13.90	12.37	15.75	18.37	17.60	15.25	16.94	14.00	12.44	14.50	13.50	11.40	14.00	16.15	28.00	29.00	25.20	38.75	17.13	22.60
November	19.50	12.87	13.75	16.00	19.20	16.50	15.44	17.50	14.00	12.25	14.75	12.62	11.00	14.50	18.50	30.00	29.00	27.62	33.80	17.50	21.00
December	19.50	12.50	14.90	16.00	21.12	15.50	16.00	17.50	14.00	13.00	15.00	12.17	11.30	16.06	20.75	30.60	29.00	30.75	24.50	16.63	20.25
Average	*17.64*	*17.05*	*12.63*	*15.34*	*16.43*	*19.52*	*14.97*	*15.56*	*15.02*	*13.25*	*13.95*	*13.39*	*12.07*	*13.03*	*17.19*	*29.35*	*29.25*	*24.03*	*35.73*	*18.49*	*18.85*

Machine Shop Turnings for Steel Works, per Gross Ton

January	$12.95	$16.00	$8.94	$14.50	$14.50	$16.05	$ 9.00	$13.63	$14.38	$8.12	$9.00	$11.20	$7.30	$8.00	$11.13	$12.90	$19.00	$12.60	$18.75	$13.00	$ 9.00
February	13.50	16.00	9.12	15.75	13.81	16.25	9.87	12.00	13.50	9.19	9.25	10.37	9.00	8.00	9.88	12.38	18.63	10.25	21.00	12.63	9.50
March	14.44	16.50	9.45	15.19	13.55	16.75	9.62	10.08	12.80	10.00	8.80	10.12	8.75	8.13	10.25	14.13	18.25	11.00	20.50	10.20	11 38
April	16.37	16.50	10.12	14.75	13.81	16.55	8.40	10.10	11.44	8.81	9.69	10.31	7.90	8.25	11.00	15.25	18.50	11.80	19.00	8.50	11 88
May	16.20	15.75	9.50	13.50	13.19	16.95	9.12	11.62	9.94	8.25	10.40	9.20	7.50	8.44	11.75	16.00	18.50	10.62	18.50	8.50	12 80
June	16.00	15.12	8.20	11.00	12.31	16.94	9.50	12.50	9.65	8.40	10.31	8.00	7.69	8.50	8.63	20.25	18.50	11.75	18.40	8.00	13 50
July	16.50	14.40	7.94	10.66	11.69	15.37	9.80	12.45	9.62	9.00	10.50	7.85	7.75	8.63	8.50	23.70	18.50	13.50	18.12	7.50	13.00
August	16.12	13.00	8.56	12.90	12.65	14.30	10.75	13.50	8.81	9.30	10.65	8.00	7.94	9.80	8.05	20.75	18.50	15.00	18.37	7.90	13.20
September	16.00	11.00	8.75	13.62	13.75	14.00	11.50	14.35	8.75	8.19	10.94	8.00	8.56	10.56	7.44	20.38	18.75	15.00	19.87	8.00	15.25
October	16.00	10.50	9.00	14.25	14.25	12.85	11.80	15.50	8.62	8.00	11.40	7.85	7.90	10.13	10.13	18.00	19.00	15.10	18.25	8.50	16.00
November	16.00	9.75	9.62	14.40	13.85	10.50	12.94	15.06	8.50	8.00	11.50	7.00	7.50	10.25	10.38	18.00	19.00	17.00	16.20	9.63	15.00
December	16.00	9.19	12.50	14.50	15.94	9.00	13.90	14.15	8.15	8.91	11.00	7.08	7.65	11.00	13.50	18.20	18.00	18.50	13.75	9.00	15.00
Average	*15.51*	*13.64*	*9.31*	*13.75*	*13.61*	*14.63*	*10.52*	*12.91*	*10.35*	*8.68*	*10.29*	*8.75*	*7.95*	*9.14*	*10.05*	*17.50*	*18.59*	*13.51*	*18.39*	*9.28*	*12.96*

Cast Borings, per Gross Ton

January	$8.00	$10.00	$6.50	$11.19	$11.00	$13.55	$7.00	$12.62	$12.22	$8.12	$8.31	$10.85	$7.80	$8.00	$11.50	$13.94	$17.00	$11.00	$22.50	$14.75	$11.90
February	8.00	10.69	7.00	11.25	10.31	14.50	8.37	11.00	11.50	8.81	8.00	10.37	9.19	8.00	11.00	13.38	17.38	9.50	23.87	13.25	12.00
March	8.62	11.12	7.35	11.31	9.85	15.37	7.75	8.17	11.20	9.60	8.50	10.06	8.94	8.00	11.00	15.00	17.50	9.50	22.10	10.00	13.00
April	10.00	11.55	7.50	11.25	10.25	15.69	7.50	8.65	10.38	8.25	9.37	10.25	8.30	8.00	11.38	15.63	17.50	13.30	20.00	9.00	12.00
May	10.05	11.06	6.75	9.87	9.50	16.00	8.12	9.87	9.84	7.75	9.60	9.17	8.00	8.00	12.75	16.10	17.50	12.50	20.00	9.00	13.10
June	10.37	10.31	6.35	8.00	9.37	16.12	8.75	10.50	8.80	7.90	9.50	8.25	8.00	8.10	10.00	21.50	17.63	12.75	20.00	9.13	13.63
July	10.50	9.40	6.12	7.83	9.31	14.37	9.00	10.40	9.50	8.63	9.56	7.85	8.00	8.50	10.00	25.00	18.00	13.80	20.00	8.63	14.00
August	10.12	8.31	6.50	9.20	10.25	13.50	10.00	11.44	9.31	8.80	9.75	7.94	8.50	9.80	9.50	22.25	18.38	14.62	20.60	9.30	14.30
September	10.00	7.50	6.75	9.87	11.25	12.81	11.00	12.45	9.25	7.69	10.06	8.18	8.56	10.44	9.13	22.00	18.75	15.25	23.62	9.13	16.00
October	10.00	7.15	7.11	9.87	11.37	11.20	11.25	13.37	9.06	7.50	10.85	7.90	8.00	10.25	10.10	19.20	19.00	17.30	22.00	10.00	16.40
November	10.19	6.81	7.75	10.60	12.50	8.37	12.00	13.19	8.50	7.50	11.37	7.50	7.50	10.05	11.63	20.00	19.00	19.62	20.60	11.38	15.75
December	10.00	6.44	9.80	10.50	13.00	7.00	12.75	12.10	8.15	8.09	10.83	7.17	7.65	11.00	14.50	20.00	17.00	21.75	16.25	11.50	15.25
Average	*9.65*	*9.20*	*7.13*	*10.06*	*10.61*	*13.21*	*9.46*	*11.15*	*9.81*	*8.22*	*9.64*	*8.79*	*8.20*	*9.01*	*11.04*	*18.87*	*17.89*	*14.24*	*20.96*	*10.42*	*13.86*

No. 1 Railroad Wrought, per Gross Ton

January	$20.00	$22.40	$15.12	$20.75	$21.16	$22.55	$14.30	$19.50	$19.56	$15.63	$15.37	$16.10	$13.05	$12.00	$22.00	$26.60	$35.00	$24.20	$33.50	$20.00	$14.50
February	21.00	22.87	15.75	21.50	19.87	21.50	15.94	17.75	18.94	16.06	14.00	15.12	14.38	12.00	21.63	25.50	35.00	21.50	36.00	19.75	14.63
March	22.50	23.25	17.20	22.37	19.20	21.12	15.31	15.00	19.00	17.20	14.12	15.35	14.00	12.50	22.13	30.75	35.00	20.25	35.90	17.20	15.38
April	24.37	23.45	17.75	22.50	20.00	20.50	15.00	15.25	18.69	16.06	15.44	15.37	13.25	12.69	23.38	36.00	35.00	21.60	35.00	17.00	15.88
May	23.60	22.50	18.75	19.20	20.60	15.00	17.12	17.50	15.25	15.75	15.00	12.63	12.94	22.50	41.40	34.00	21.00	33.50	15.20	16.90	
June	23.37	20.87	13.00	16.00	17.87	20.75	15.25	18.19	16.70	15.00	15.44	14.75	12.50	13.00	20.50	51.25	34.00	21.50	33.00	14.38	17.00
July	23.00	19.40	12.69	16.16	17.50	19.12	15.95	17.45	16.00	15.13	15.50	13.90	12.20	13.44	19.50	50.60	34.00	24.40	33.00	13.50	17.13
August	23.00	17.50	13.44	18.80	19.70	18.30	17.50	18.87	15.37	15.70	15.80	14.00	12.00	14.95	20.20	45.00	34.00	26.50	33.00	14.00	18.00
September	23.75	17.00	14.45	20.50	21.25	18.00	18.25	19.95	16.10	14.75	16.31	14.68	12.38	16.50	20.00	44.00	34.00	26.50	33.25	15.00	20.88
October	23.70	16.50	15.37	21.62	22.25	17.50	18.30	20.75	16.19	13.94	16.80	14.00	11.80	16.13	21.63	37.20	34.00	26.90	29.25	15.88	22.20
November	22.50	15.25	17.00	22.70	22.25	15.75	19.19	20.75	16.00	13.85	17.06	13.00	11.50	16.50	24.13	35.00	34.00	28.37	25.00	16.00	19.00
December	22.00	14.50	19.10	21.87	23.25	14.62	19.95	19.50	15.90	15.00	16.25	12.75	11.50	20.06	26.75	35.00	33.00	30.25	20.00	14.63	19.25
Average	*22.73*	*19.62*	*15.55*	*20.29*	*20.29*	*19.19*	*16.66*	*18.34*	*17.16*	*15.30*	*15.65*	*14.49*	*12.60*	*14.39*	*22.03*	*38.19*	*34.25*	*24.41*	*31.70*	*16.84*	*17.56*

Old Cast Iron Carwheels, per Gross Ton

January	$16.95	$20.30	$12.87	$16.00	$18.75	$23.00	$18.20	$16.00	$17.50	$13.00	$12.37	$16.30	$12.20	$11.00	$16.38	$21.50	$30.00	$24.60	$36.00	$25.00	$15.50
February	17.00	22.62	13.00	16.00	18.75	23.00	16.62	15.50	16.81	13.44	12.00	15.37	12.63	10.63	16.50	20.50	30.00	23.00	40.62	24.00	15.00
March	17.44	24.50	13.20	16.70	17.70	23.62	15.00	14.00	16.75	14.00	11.94	15.00	12.50	11.00	16.70	21.50	30.00	23.00	42.40	18.50	15.94
April	17.75	24.20	13.50	17.00	16.75	24.00	14.00	14.05	16.06	13.19	12.87	14.87	12.00	11.00	17.38	25.75	29.00	23.10	40.00	18.00	15.88
May	19.50	23.62	12.00	16.00	16.75	24.80	14.00	14.25	15.12	13.00	13.90	13.75	11.75	11.38	16.70	28.00	29.00	21.00	40.00	16.80	16.70
June	19.75	21.87	11.20	14.90	16.69	25.37	13.75	15.00	14.90	13.10	14.00	13.12	11.19	11.55	16.38	34.00	29.00	22.00	38.00	18.00	17.13
July	20.60	21.30	10.75	14.25	16.19	25.00	13.50	15.05	14.25	12.94	14.00	12.30	11.00	12.38	15.63	36.20	29.00	23.20	38.50	16.50	17.50
August	20.00	19.12	11.25	15.20	16.75	23.90	14.75	15.62	13.94	13.00	14.05	12.37	11.25	13.25	15.50	34.50	29.00	24.50	40.60	16.40	18.10
September	20.00	18.25	11.80	15.50	18.27	23.00	15.00	16.80	13.75	12.56	14.25	12.75	11.25	14.00	15.50	32.50	29.00	24.50	42.75	17.00	21.75
October	19.25	16.40	12.37	16.37	20.94	22.40	15.00	17.50	13.75	11.75	14.87	12.46	10.10	13.75	15.88	29.00	29.00	24.50	40.50	17.00	22.50
November	20.50	14.43	13.81	17.10	22.00	19.00	15.62	17.50	13.50	11.35	15.00	12.00	9.50	14.05	18.88	31.25	29.00	27.75	36.40	17.20	20.50
December	20.00	12.75	14.60	18.12	23.00	19.00	16.00	17.50	13.25	12.33	15.50	12.00	10.00	15.63	22.38	32.40	28.00	30.50	26.00	16.63	20.00
Average	*19.06*	*19.95*	*12.53*	*16.10*	*18.55*	*23.01*	*15.12*	*15.73*	*14.97*	*12.81*	*13.73*	*13.52*	*11.28*	*12.47*	*16.98*	*28.93*	*29.17*	*24.30*	*38.48*	*18.42*	*18.13*

Heavy Melting Steel Scrap Prices, Pittsburgh

Dollars per Gross Ton

	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	$21.20	$12.50	$16.25	$17.25	$18.95	$12.80	$16.63	$17.69	$13.50	$12.75	$14.95	$10.90	$11.63	$17.50	$22.60	$30.00	$19.00	$26.30	$15.50	$14.30
February	21.13	13.50	15.88	16.31	18.06	13.88	15.63	17.25	14.13	12.12	14.19	12.62	11.63	17.06	21.75	30.00	14.75	27.75	16.60	14.00
March	21.00	14.00	15.90	14.70	18.00	13.19	14.19	16.80	14.35	12.62	14.19	12.12	12.00	18.45	23.25	30.00	14.00	27.25	14.90	15.13
April	21.50	13.63	16.00	14.75	17.94	12.80	14.00	16.50	13.06	13.06	14.19	12.00	11.81	17.81	28.00	28.50	15.20	26.00	12.63	16.38
May	21.25	12.13	15.00	14.80	18.10	12.81	14.81	15.30	12.62	13.25	13.55	12.00	11.75	16.95	28.80	28.50	14.75	25.00	13.30	17.30
June	20.00	11.30	13.90	15.63	18.38	13.13	15.69	15.10	12.95	13.44	12.62	12.00	11.75	15.88	41.00	28.62	17.12	25.00	12.69	17.00
July	19.70	10.75	14.00	15.75	18.06	14.25	15.90	14.50	13.06	13.34	12.40	12.00	12.31	16.31	39.00	29.00	19.70	26.00	12.00	17.28
August	18.50	11.38	14.85	16.50	17.75	14.81	16.31	14.31	13.20	13.55	12.37	11.50	13.81	16.05	32.83	29.00	21.00	28.13	12.70	17.75
September	17.25	11.50	15.88	16.88	17.38	14.25	17.40	14.38	12.50	14.11	12.25	11.31	14.30	16.19	33.25	29.00	19.20	29.00	13.63	20.13
October	15.30	12.25	16.50	17.13	17.10	15.20	17.94	14.25	12.06	15.85	11.85	10.85	14.38	18.25	28.80	29.00	19.00	27.75	14.13	21.40
November	13.25	14.25	17.50	18.00	14.88	16.06	17.50	14.25	12.00	15.12	11.44	10.00	15.88	21.20	29.50	28.87	22.25	23.50	14.30	20.50
December	11.20	16.20	17.63	20.00	13.00	16.70	18.00	13.75	12.31	14.75	11.06	10.75	17.45	26.00	30.00	26.87	24.25	17.20	14.25	20.13
Average	*18.44*	*12.78*	*15.77*	*16.48*	*17.30*	*14.51*	*16.17*	*15.34*	*12.98*	*13.66*	*12.92*	*11.50*	*13.23*	*18.14*	*29.90*	*28.95*	*18.35*	*25.74*	*13.76*	*17.62*

Metals, Tin Plate and Sheets for Twenty-One Years

Lake Copper, at New York, Cents per Pound (1920, 1921 and 1922 Prices are Electrolytic Copper)

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January ..	11.45	12.13	12.62	15.18	18.78	24.41	13.90	14.56	14.00	12.81	14.50	16.98	14.85	14.02	24.39	29.73	23.50	20.48	19.27	12.95	13.55
February .	12.47	12.80	12.34	15.25	17.94	25.10	13.13	13.37	13.78	12.75	14.41	15.55	15.00	15.21	26.85	34.90	23.50	17.86	19.02	12.84	12.92
March....	12.12	14.31	12.60	15.25	18.50	23.38	12.85	12.90	13.75	12.58	14.88	15.05	14.79	15.75	27.10	35.85	23.50	15.46	18.50	12.19	12.68
April ...	11.97	14.85	13.19	15.18	18.62	24.62	13.09	12.94	13.31	12.41	16.00	15.67	14.75	18.90	28.27	31.67	23.50	15.55	19.19	12.49	12.61
May	12.10	14.75	13.28	15.00	18.70	24.10	12.88	13.21	13.06	12.33	16.30	15.91	14.40	21.00	28.88	31.42	23.50	16.18	19.05	12.79	13.13
June	12.23	14.56	12.74	15.00	18.69	23.94	13.00	13.50	12.88	12.71	17.53	15.42	14.12	23.38	27.82	32.46	23.50	17.95	19.00	12.88	13.62
July.....	11.94	13.73	12.62	15.03	18.47	21.95	13.00	13.34	12.66	12.78	17.54	14.78	13.70	21.98	25.84	28.78	25.80	22.07	19.00	12.46	13.71
August ..	11.59	13.35	12.50	16.07	18.65	18.94	13.71	13.56	12.93	12.75	17.73	15.86	12.85	19.33	26.95	27.24	26.00	23.16	19.00	11.70	13.74
September	11.60	13.58	12.67	16.12	19.31	16.41	13.80	13.50	12.81	12.65	17.77	16.77	12.66	17.97	28.03	24.90	26.00	22.68	18.70	12.01	13.75
October...	11.71	13.42	13.09	16.62	21.81	13.80	13.81	13.19	12.84	12.53	17.80	16.85	11.73	17.89	28.48	23.50	26.00	22.13	16.56	12.67	13.66
November	11.44	13.25	14.22	16.90	22.50	13.94	14.44	13.44	12.98	12.80	17.70	16.16	12.00	18.92	32.32	23.50	26.00	20.69	14.63	13.07	13.62
December.	11.61	12.30	14.87	18.75	23.06	13.48	14.53	13.80	13.00	13.84	17.69	14.88	13.35	20.24	33.38	23.50	25.40	18.90	13.63	13.55	14.00
Average.	*11.85*	*13.59*	*13.06*	*15.86*	*19.59*	*20.34*	*13.51*	*13.44*	*13.17*	*12.75*	*16.65*	*15.82*	*13.68*	*18.72*	*28.19*	*28.95*	*24.68*	*19.43*	*17.96*	*12.63*	*13.42*

Spelter, at New York, Cents per Pound

January ..	4.28	4.82	4.95	6.17	6.48	6.90	4.54	5.15	6.26	5.55	6.52	7.15	5.29	6.59	18.19	9.94	7.88	7.38	9.62	5.83	5.06
February .	4.18	5.00	4.95	6.12	6.09	7.00	4.78	4.99	5.89	5.56	6.71	6.45	5.40	8.84	20.13	10.48	7.99	6.70	9.14	5.36	4.85
March....	4.29	5.36	5.05	6.06	5.96	6.92	4.76	4.81	5.72	5.65	6.98	6.26	5.28	9.29	18.40	10.77	7.64	6.52	8.93	5.20	5.00
April ...	4.41	5.65	5.22	5.97	6.05	6.81	4.68	4.94	5.60	5.51	6.86	5.77	5.18	11.22	18.58	9.85	7.01	6.51	8.63	5.24	5.25
May	4.50	5.75	5.14	5.55	5.95	6.51	4.60	5.12	5.20	5.50	6.86	5.47	5.06	16.14	15.86	9.46	7.32	6.46	8.08	5.28	5.45
June	4.88	6.00	4.79	5.32	6.14	6.45	4.56	5.39	5.19	5.63	6.99	5.18	5.09	22.18	12.75	9.62	8.01	6.93	7.92	4.95	5.69
July.....	5.23	5.95	4.85	5.38	5.98	6.15	4.46	5.35	5.20	5.79	7.26	5.38	5.02	20.58	9.83	8.95	8.69	7.90	8.18	4.77	6.12
August ..	5.46	5.94	4.85	5.66	6.06	5.71	4.71	5.74	5.26	6.04	7.19	5.75	5.60	14.11	8.98	8.69	8.96	7.84	8.31	4.69	6.59
September	5.45	6.00	5.06	5.83	6.19	5.28	4.76	5.85	5.53	6.03	7.53	5.82	5.50	14.16	8.22	8.34	9.60	7.57	7.82	4.74	6.91
October...	5.48	6.05	5.17	6.05	6.18	5.45	4.81	6.09	5.69	6.20	7.57	5.42	4.97	13.96	9.98	8.24	9.11	7.83	7.51	5.10	7.20
November	5.29	5.68	5.49	6.17	6.36	5.10	5.03	6.32	5.95	6.60	7.48	5.29	5.12	17.15	11.90	7.95	8.70	8.14	6.84	5.18	7.48
December.	4.91	5.15	5.80	6.50	6.62	4.39	5.17	6.35	5.80	6.44	7.33	5.18	5.71	16.69	11.13	7.84	8.45	8.59	6.00	5.25	7.46
Average.	*4.86*	*5.21*	*5.11*	*5.90*	*6.17*	*6.06*	*4.74*	*5.51*	*5.61*	*5.88*	*7.11*	*5.76*	*5.27*	*14.24*	*13.66*	*9.18*	*8.28*	*7.36*	*8.08*	*5.13*	*6.09*

Lead, at New York, Cents per Pound

January ..	4.02	4.10	4.39	4.56	5.86	6.30	3.73	4.19	4.70	4.50	4.41	4.35	4.11	3.74	5.93	7.69	6.87	5.56	8.67	5.00	4.70
February .	4.10	4.10	4.40	4.50	5.56	6.31	3.75	4.07	4.63	4.46	4.00	4.35	4.06	3.82	6.23	9.13	7.04	5.05	8.88	4.54	4.70
March....	4.10	4.44	4.50	4.45	5.35	6.31	3.88	4.02	4.51	4.41	4.08	4.35	3.97	4.04	7.43	9.47	7.24	5.23	9.21	4.08	4.71
April ...	4.10	4.59	4.50	4.50	5.39	6.16	4.02	4.19	4.40	4.44	4.20	4.40	3.82	4.20	7.73	9.43	6.95	5.03	8.95	4.33	5.13
May	4.10	4.37	4.48	4.50	5.90	6.02	4.26	4.32	4.37	4.40	4.20	4.37	3.90	4.25	7.45	11.00	6.88	5.05	8.55	4.99	5.51
June	4.10	4.25	4.22	4.51	5.94	5.75	4.45	4.36	4.38	4.46	4.50	4.35	3.90	5.89	6.87	11.68	7.55	5.34	8.48	4.56	5.73
July.....	4.10	4.12	4.17	4.56	5.80	5.24	4.50	4.35	4.40	4.50	4.67	4.37	3.90	5.59	6.34	10.72	8.04	5.65	8.67	4.40	5.75
August ..	4.10	4.12	4.15	4.64	5.78	5.12	4.50	4.36	4.40	4.50	4.54	4.64	3.87	4.68	6.26	10.72	8.05	5.77	8.98	4.40	5.88
September	4.10	4.26	4.20	4.85	5.92	4.84	4.54	4.39	4.40	4.49	5.04	4.73	3.86	4.62	6.88	8.84	8.05	6.12	8.11	4.60	6.20
October...	4.10	4.40	4.20	5.07	5.94	4.64	4.34	4.39	4.40	4.31	5.06	4.52	3.52	4.60	7.00	6.77	8.05	6.45	7.24	4.70	6.67
November	4.10	4.25	4.51	5.48	5.97	4.45	4.39	4.40	4.44	4.31	4.66	4.33	3.68	5.16	7.13	6.44	8.05	6.76	6.33	4.70	7.20
December.	4.10	4.19	4.60	5.96	6.19	3.76	4.24	4.56	4.50	4.45	4.32	4.06	3.80	5.33	7.60	6.48	6.71	7.03	4.80	4.70	7.28
Average.	*4.09*	*4.27*	*4.36*	*4.80*	*5.80*	*5.41*	*4.22*	*4.30*	*4.46*	*4.44*	*4.47*	*4.40*	*3.87*	*4.66*	*6.90*	*9.03*	*7.46*	*5.76*	*8.07*	*4.58*	*5.79*

Straits Tin, at New York, Cents per Pound

January ..	23.38	27.76	28.75	29.18	36.36	42.14	27.43	28.19	32.61	41.20	44.58	50.34	39.12	34.13	41.76	44.10	85.13	71.50	62.74	35.94	32.03
February .	24.73	29.14	27.98	29.49	36.48	42.16	28.74	28.44	32.65	43.34	43.56	48.71	39.82	37.25	42.60	51.47	85.00	72.45	59.87	32.16	30.74
March....	26.16	30.06	26.19	29.21	36.62	41.29	30.46	28.75	32.51	41.10	42.76	46.93	38.03	48.73	50.53	58.38	85.00	72.50	61.93	28.79	29.14
April ...	27.29	29.69	27.99	30.43	38.86	40.84	31.79	29.35	32.83	42.05	43.64	49.04	36.10	47.64	51.51	55.82	88.53	72.50	62.12	30.36	30.58
May	29.26	29.26	27.76	30.04	43.08	43.01	29.84	29.07	33.05	43.32	45.98	49.06	33.21	38.79	49.14	63.21	100.00	72.50	54.99	32.50	30.92
June	29.29	28.30	26.14	30.36	38.97	42.65	28.18	29.26	32.79	46.25	47.44	45.01	30.60	40.26	42.07	61.93	91.00	71.83	48.34	29.39	31.46
July.....	28.28	27.60	26.28	31.71	37.18	41.15	28.92	29.05	32.99	43.23	44.70	41.32	35.65	37.38	38.25	62.61	93.00	70.11	49.29	27.69	31.67
August ..	28.14	28.00	26.74	32.85	39.90	37.35	29.99	29.96	33.92	43.38	45.86	41.63	48.34	34.37	38.88	62.53	91.33	62.20	47.60	26.35	32.36
September	26.55	27.06	27.27	32.21	40.32	37.22	28.91	30.00	35.17	39.69	49.16	42.63	31.13	33.13	38.65	61.54	80.40	59.79	44.43	26.70	32.36
October...	25.76	25.83	28.53	32.47	42.90	32.33	29.44	30.41	36.76	41.23	50.07	40.38	30.25	33.05	41.10	62.24	78.82	54.82	40.47	27.70	34.61
November	25.43	25.35	29.00	33.46	42.70	30.81	30.43	30.74	37.38	43.08	49.87	39.75	33.28	39.50	44.12	74.18	73.67	54.17	36.97	28.93	36.76
December.	25.33	27.53	29.27	35.84	42.62	27.92	29.13	32.91	38.21	45.03	49.86	37.12	34.01	38.53	42.55	84.74	71.51	53.80	34.04	32.41	37.48
Average.	*26.63*	*27.97*	*27.66*	*31.44*	*39.67*	*38.24*	*29.44*	*29.68*	*34.24*	*42.74*	*46.46*	*44.33*	*35.80*	*38.56*	*43.43*	*61.90*	*85.28*	*65.68*	*50.23*	*29.91*	*32.51*

Tin Plate, at Pittsburgh, Dollars per Box

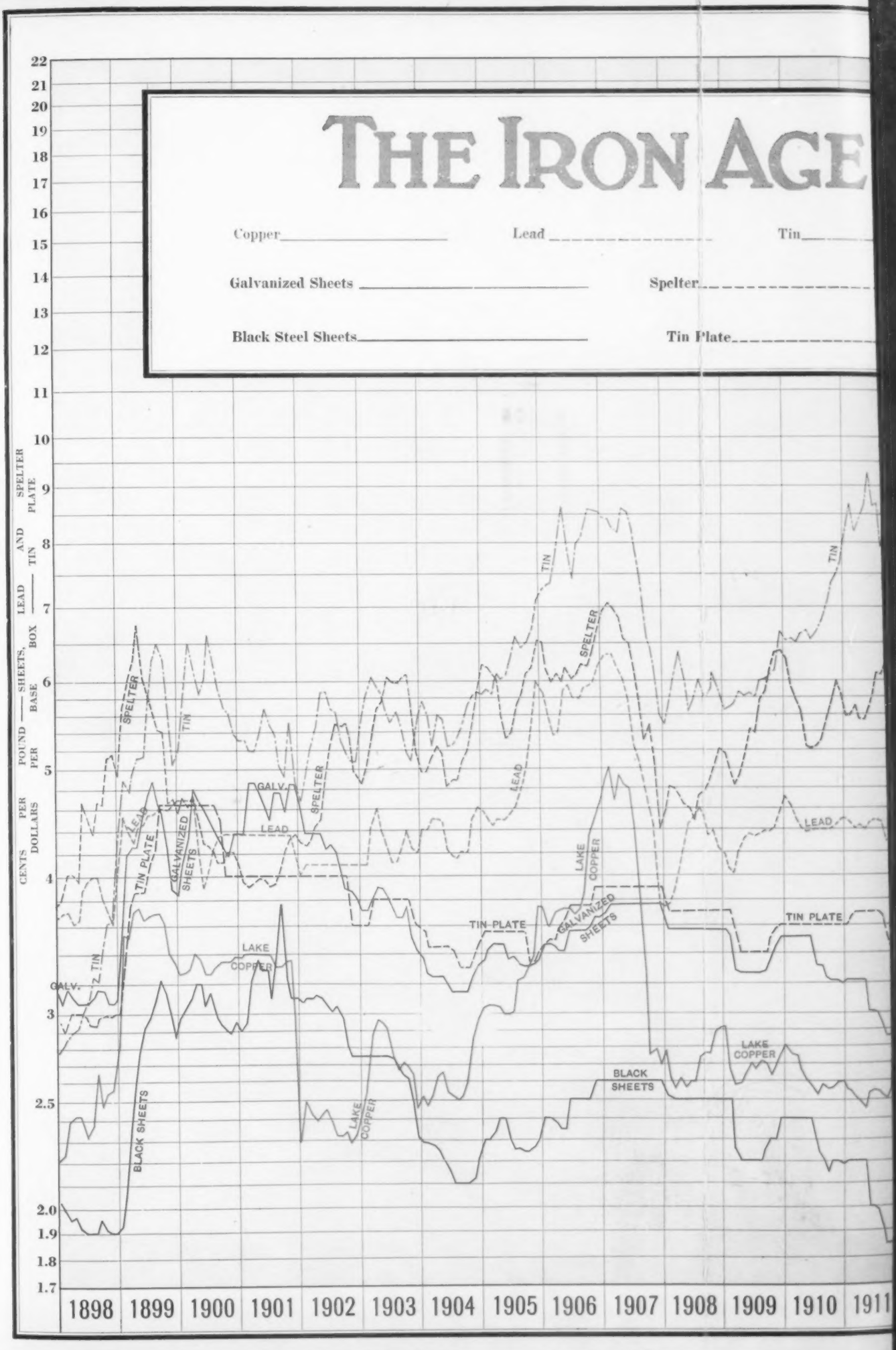
January ..	$4.00	$3.60	$3.56	$3.55	$3.47	$3.90	$3.74	$3.70	$3.60	$3.60	$3.40	$3.60	$3.32	$3.10	$3.75	$7.00	$7.75	$7.35	$7.00	$7.00	$4.75
February .	4.00	3.60	3.45	3.55	3.50	3.90	3.70	3.60	3.67	3.35	3.60	3.29	3.10	3.96	7.38	7.75	7.35	7.00	7.00	4.71
March....	4.00	3.80	3.45	3.55	3.50	3.90	3.70	3.53	3.60	3.70	3.30	3.60	3.30	3.25	4.19	8.00	7.75	7.26	7.00	7.00	4.60
April	4.00	3.80	3.45	3.55	3.57	3.90	3.70	3.40	3.60	3.70	3.30	3.60	3.30	3.25	4.50	8.00	7.75	7.00	7.00	6.44	4.75
May	4.00	3.80	3.45	3.55	3.66	3.90	3.70	3.40	3.60	3.70	3.33	3.60	3.30	3.15	5.30	8.40	7.75	7.00	7.00	6.25	4.75
June	4.00	3.80	3.45	3.55	3.75	3.90	3.70	3.40	3.60	3.70	3.40	3.60	3.30	3.11	5.81	10.50	7.75	7.00	7.00	6.25	4.75
July.....	4.00	3.80	3.41	3.55	3.75	3.90	3.70	3.40	3.60	3.70	3.43	3.60	3.27	3.10	6.00	12.00	7.75	7.00	7.50	5.69	4.75
August ...	4.00	3.80	3.30	3.55	3.75	3.90	3.70	3.40	3.60	3.70	3.50	3.55	3.41	3.10	5.95	11.40	7.75	7.00	9.00	5.25	4.75
September	4.00	3.80	3.30	3.55	3.75	3.90	3.70	3.40	3.60	3.67	3.58	3.50	3.35	3.15	5.75	12.00	7.75	7.00	9.00	5.25	4.75
October...	4.00	3.80	3.30	3.34	3.75	3.90	3.70	3.50	3.60	3.52	3.60	3.50	3.24	3.15	5.81	.....	7.75	7.00	8.33	5.13	4.75
November	3.60	3.65	3.39	3.34	3.90	3.90	3.70	3.56	3.60	3.40	3.60	3.40	3.15	3.28	5.97	7.75	7.75	7.00	7.50	4.75	4.75
December.	3.60	3.60	3.47	3.40	3.90	3.90	3.70	3.60	3.60	3.40	3.60	3.40	3.13	3.52	6.63	7.75	7.55	7.00	7.00	4.73	4.75
Average.	*3.93*	*3.74*	*3.42*	*3.50*	*3.09*	*3.90*	*3.70*	*3.50*	*3.60*	*3.62*	*3.45*	*3.55*	*3.28*	*3.19*	*5.30*	*9.11*	*7.73*	*7.08*	*7.53*	*5.90*	*4.73*

No. 28 Black Sheets, at Pittsburgh, Cents per Pound

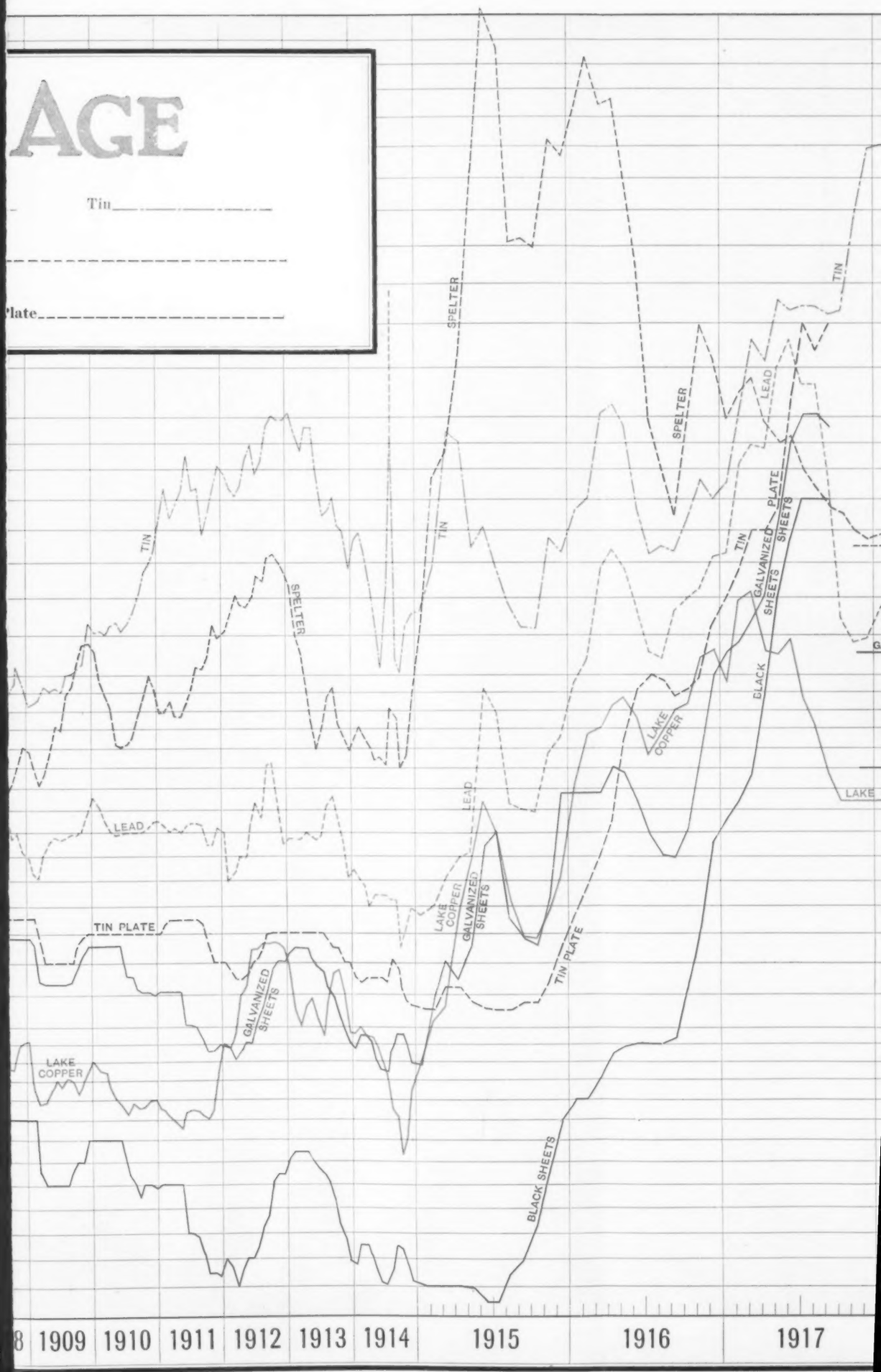
January...	3.08	2.75	2.29	2.30	2.40	2.60	2.52	2.50	2.40	2.20	1.90	2.31	1.87	1.80	2.60	4.50	5.00	4.70	4.48	4.35	3.00
February..	3.10	2.75	2.28	2.30	2.40	2.60	2.50	2.50	2.40	2.20	1.87	2.35	1.95	1.80	2.60	4.69	5.00	4.70	5.00	4.21	3.00
March....	3.10	2.75	2.27	2.34	2.38	2.60	2.50	2.25	2.40	2.20	1.80	2.35	1.95	1.80	2.71	4.94	5.00	4.61	5.50	3.88	3.00
April.....	3.13	2.75	2.25	2.40	2.35	2.60	2.50	2.20	2.40	2.20	1.86	2.35	1.91	1.80	2.85	5.75	5.00	4.35	5.50	3.88	3.11
May.....	3.10	2.75	2.20	2.40	2.35	2.60	2.50	2.20	2.40	2.20	1.90	2.30	1.85	1.79	2.89	7.00	5.00	4.35	5.50	4.00	3.15
June.....	3.05	2.75	2.16	2.30	2.50	2.60	2.50	2.20	2.40	2.00	1.90	2.27	1.81	1.75	2.90	7.88	5.00	4.35	5.50	3.80	3.15
July.....	3.00	2.74	2.10	2.26	2.50	2.60	2.50	2.20	2.24	2.00	1.95	2.25	1.80	1.75	2.90	8.50	5.00	4.35	6.75	3.31	3.15
August....	3.05	2.70	2.10	2.26	2.50	2.60	2.50	2.20	2.21	1.99	2.02	2.21	1.86	1.85	2.90	8.50	5.00	4.35	7.50	2.90	3.23
September.	2.98	2.65	2.10	2.25	2.50	2.60	2.50	2.26	2.15	1.91	2.07	2.14	1.95	1.90	2.93	8.50	5.00	4.35	7.38	2.81	3.35
October...	2.79	2.62	2.10	2.25	2.50	2.60	2.50	2.30	2.20	1.85	2.21	2.04	1.94	2.03	3.23	.....	5.05	4.35	6.69	3.00	3.47
November.	2.75	2.49	2.13	2.27	2.60	2.60	2.50	2.30	2.20	1.85	2.25	1.97	1.87	2.25	3.65	5.00	5.00	4.35	5.77	2.86	3.35
December.	2.75	2.32	2.22	2.30	2.60	2.60	2.50	2.40	2.19	1.84	2.25	1.89	1.82	2.50	4.31	5.00	4.85	4.35	4.35	3.00	3.35
Average..	*2.99*	*2.67*	*2.18*	*2.30*	*2.47*	*2.60*	*2.50*	*2.29*	*2.30*	*2.04*	*2.00*	*2.20*	*1.88*	*1.92*	*3.04*	*6.39*	*4.99*	*4.43*	*5.83*	*3.50*	*3.19*

No. 28 Galvanized Sheets, at Pittsburgh, Cents per Pound

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January...	4.64	3.70	3.36	3.35	3.45	3.67	3.59	3.55	3.50	3.20	2.90	3.46	2.87	2.79	4.75	6.25	6.35	6.05	5.33	5.70	4.00
February..	4.36	3.70	3.25	3.40	3.45	3.75	3.55	3.51	3.50	3.20	2.87	3.50	2.95	3.16	4.75	6.38	6.25	6.05	6.50	5.56	4.00
March....	4.36	3.78	3.23	3.45	3.43	3.75	3.55	3.26	3.50	3.20	2.80	3.50	2.95	3.40	4.75	6.69	6.25	5.96	7.00	5.05	4.00
April.....	4.36	3.89	3.23	3.45	3.40	3.75	3.55	3.25	3.50	3.20	2.86	3.50	2.91	3.29	5.00	7.00	6.25	5.70	7.00	4.88	4.11
May.....	4.36	3.88	3.23	3.45	3.40	3.75	3.55	3.25	3.50	3.20	2.90	3.42	2.80	3.50	4.94	8.20	6.25	5.70	7.00	5.00	4.15
June.....	4.23	3.81	3.18	3.35	3.55	3.75	3.55	3.25	3.50	3.00	2.90	3.38	2.75	4.28	4.69	9.50	6.25	5.70	7.00	4.88	4.15
July.....	4.26	3.73	3.14	3.36	3.55	3.75	3.55	3.25	3.30	3.00	3.00	3.33	2.75	4.40	4.38	10.00	6.25	5.70	8.25	4.31	4.15
August....	4.18	3.66	3.14	3.32	3.55	3.75	3.55	3.25	3.30	2.99	3.12	3.24	2.85	3.71	4.21	10.00	6.25	5.70	9.00	3.90	4.23
September.	3.99	3.66	3.14	3.30	3.55	3.75	3.55	3.28	3.21	2.93	3.21	3.16	2.95	3.56	4.18	9.75	6.25	5.70	8.88	3.81	4.35
October...	3.87	3.73	3.14	3.30	3.58	3.75	3.55	3.35	3.20	2.85	3.36	3.08	2.95	3.50	4.41	.....	6.25	5.70	8.18	4.00	4.50
November.	3.85	3.51	3.23	3.32	3.65	3.75	3.55	3.43	3.20	2.85	3.40	2.98	2.88	3.89	5.18	6.25	6.25	5.70	7.04	3.86	4.43
December.	3.78	3.40	3.31	3.35	3.65	3.75	3.55	3.50	3.19	2.89	3.40	2.90	2.78	4.75	6.00	6.25	6.15	5.70	5.70	4.00	4.35
Average..	*4.19*	*3.70*	*3.22*	*3.37*	*3.52*	*3.74*	*3.55*	*3.34*	*3.37*	*3.04*	*3.06*	*3.29*	*2.87*	*3.69*	*4.77*	*7.84*	*6.24*	*5.78*	*7.24*	*4.58*	*4.20*



Quarter Century of Fluctuations in Carload Prices of Copper, L



s of Copper, Lead, Tin and Spelter in New York and Tin Plate

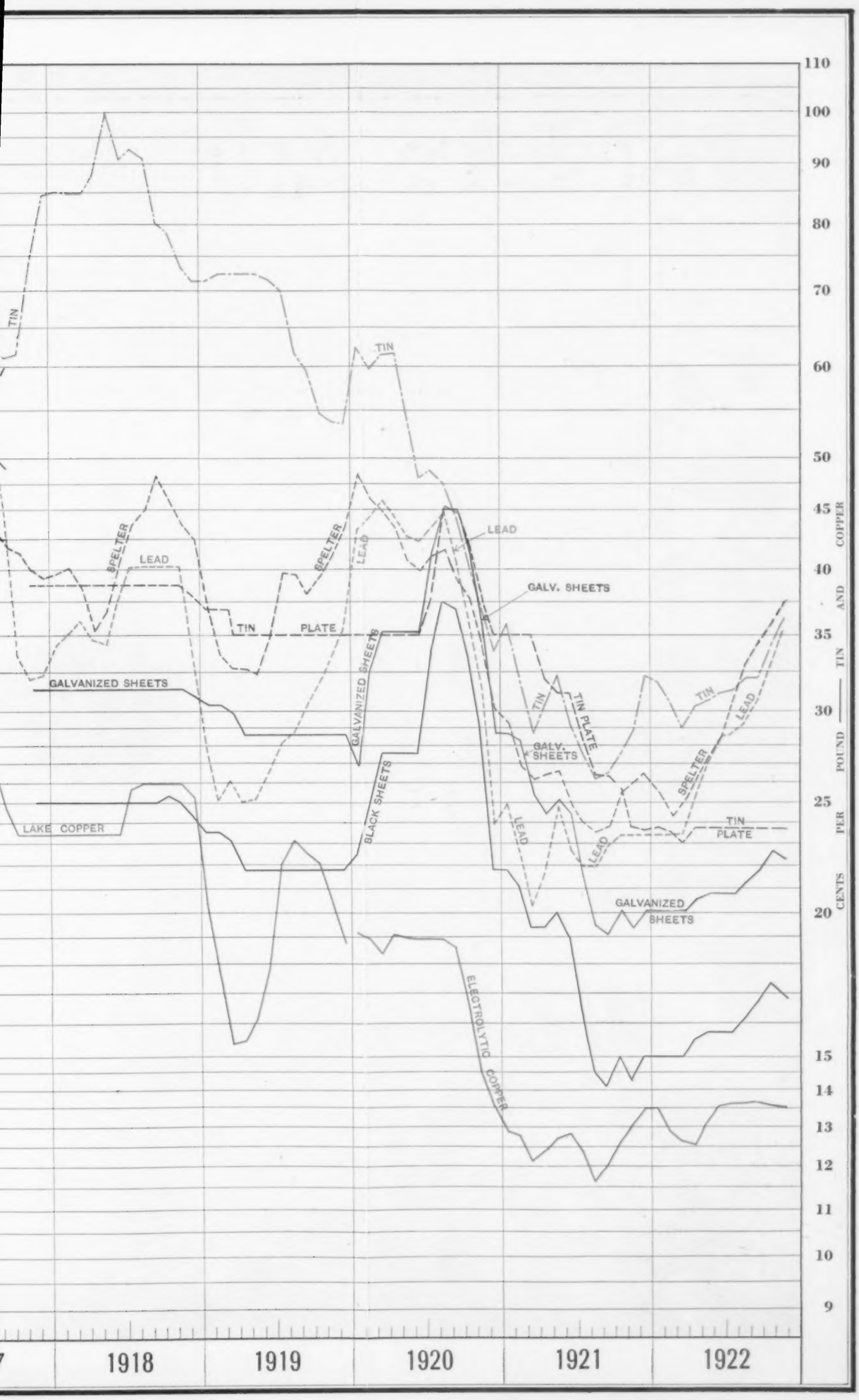


Plate and No. 28 Black and Galvanized Sheets in Pittsburgh

Year of Distress for German Steel Industry

(*Concluded from page 66*)

374 marks; on Aug. 1, 644; on Sept. 1, 1300; on Oct. 1, 1815; on Oct. 15, 2880; on Nov. 1, 7000—and from thence up to 9200 marks for one dollar. One may see that these enormous jumps have been caused by the war payment (up to date more than 41,000,000,000 gold marks), the burdens imposed by the occupation of great .istricts, and the necessity of purchasing foreign raw materials and food for the sustenance of the 60,000,000 inhabitants. In fact, the mark is no more the measure of the value of any product; its worth has been replaced by its relation to the dollar and, of course, this proportion is also the basis of all price regulations.

These circumstances explained how in a hardware manufacturing shop employing about 650 men the average wage per day has risen from 105 marks in January to 176 marks on April 1, 197 marks on July 1, 573 on Aug. 1, 623 on Oct. 1, 900 on Nov. 1 and now to 1600 and 2200. The salaries of employees were 3635 marks on Jan. 1, 24,060 on Sept. 1, 36,700 on Oct. 1, and are now 63,000 marks per month. A coal miner's yearly income has risen at the present scale to about 600,000 marks. These rates jump from day to day. The whole situation in Germany has been fundamentally altered in recent weeks and nobody knows the future.

Technical Progress

In respect to technical progress, the year has seen no revolutionizing movements, but in consequence of the increasing scarcity and cost of coal much valuable work has been done in the introduction of improvements for saving fuel. For this purpose there have been formed the so-called "warmesteller" organizations under the management of specially educated engineers who visit regularly the coal consuming works and give advice. This institution, which has proved a complete success, is maintained by small contributions of the works.

It may be mentioned that in the Gelsenkirchen collieries a new process has been introduced in which by electro-osmose the coal slime is cleaned of the slag; the ash in the coke is thus reduced from 9.3 to 5.2 per cent. In a similar manner all industrial works are compelled by rising wages to substitute machinery for hand labor, and much has been done in this direction.

Mehlem-on-the-Rhine, Germany,
Nov. 29, 1922.

NEAR 1919 PEAK

Rapid Recovery of Business Shown by Survey of Many Industries

In its ninth bi-monthly review of industrial-economic conditions in the United States, just issued, the National Industrial Conference Board says:

"The recovery of business in the United States since the severe depression late in 1920 and early in 1921 has been unusually rapid, and industrial activity today is fast approaching the level at the peak of the boom of 1919-1920. General business is probably not quite up to this point, but the general situation is sound and far better than could have been reasonably expected at the beginning of 1921 or even at the beginning of 1922.

"The business and industrial situation as a whole has shown a remarkable degree of improvement since the slump of 1920 and 1921. An index of industrial activity compiled by the National Industrial Conference Board and including 17 of the principal basic industries of the United States showed that, compared with the monthly average for 1919-21 as a base, industrial activity for the month of October stood at 124.8. This compares very favorably with 65.7, the index number for January, 1921, and the low point since the beginning of 1915. The peak was reached in October, 1919, and the high point for 1922 so far was reached in June, when the index stood at 119.9.

"This index of industrial activity shows that the index rose 10 per cent from September to October and was 22.6 per cent higher in October, 1922, than in October, 1921. These facts indicate that industry has recovered much more rapidly than is generally supposed and that it is now at a very high point. In fact, it has been higher only on two occasions, namely, in July, 1918, and during the after-war boom in 1919 and 1920.

Steady Improvement

"During October and November there was a steady improvement in the industrial situation. Fundamental conditions have become more sound. The evidence of this is to be found in those indices which are commonly accepted as measuring business conditions. The production of pig iron and steel ingots has increased, and during October it reached the highest point since the beginning of 1921. The unfilled tonnage of the United States Steel Corporation also rose considerably, indicating that even the increased production of iron and steel during October is by no means keeping pace with demand, which continues at a high rate. Commercial failures have decreased. Railroad car loadings have reached almost record-breaking figures; in fact, car loadings for the first ten months of 1922 are higher than for any similar period.

"Prices have somewhat advanced and the tendency during the past two months has been slightly upward. Wholesale prices have increased appreciably and in most lines seem to be firm and strong. Prices of staple raw materials have shown a considerable advance. Retail prices, however, have not as yet reflected the increase in wholesale prices and, with the exception of those of coal and food, remain almost stationary.

Agricultural Conditions

"The agricultural crops of the country are larger than usual. Prices, however, except for cotton, are relatively low. As a group, prices of agricultural products have advanced less beyond pre-war levels than prices of any other of the principal commodity groups. This condition has caused criticism and unrest in agricultural sections of the country, where it is felt that the general prosperity of the industrial districts has not been shared.

"The most serious impediment to increasing business and further industrial activity is the car shortage, which has prevented those industries that ship in carload lots from attaining as large an output as they would otherwise have been able to effect. This condition is partly an echo of the railway shopmen's strike during the summer, but is more definitely a result of the tremendous volume of industrial and agricultural products which the railroads have been called upon to transport.

"Labor shortage, particularly of the unskilled, has also handicapped some industries, and is considered an obstacle to any great increase in activity in the basic industries. The restrictions which have been placed on immigration, together with the large outflow of emigrants, are thought to have seriously affected the supply of labor, and to have led to the prevailing upward movement of wages."

The Ford Motor Co. has announced that it will erect a glass plant at River Rouge, Detroit, following a year of successful experimenting at its temporary plant at Highland Park. The company has also announced that in the near future its authorized agencies will distribute ammonium sulphate for fertilizing purposes, this product being a by-product of the coke ovens at the Rouge plant.

The American Car & Foundry Co., 5718 Russell Street, Detroit, has disposed of its rolling mill property at Clark and West Jefferson Streets, to the Burt D. Howe Co., First National Bank Building. The new owner will dismantle the plant and dispose of the equipment, including 16-in. bar mill, boilers, engines, heating furnaces, etc.

Electric Steel Industry After Ten Years

American Industry Credited with 406 Furnaces Against Only 19 in 1913—The Canadian Industry and That of the World

BY EDWIN F. CONE

NO marked increase in capacity and no outstanding developments marked the progress of the American electric steel industry in 1922. The net increase in actual furnace installations, while substantial, was not large. They were mostly small furnaces. Actual sales were larger than the net increase, for in several types the dismantling or discontinuance of some furnaces offset part of the increase due to sales. In number of new installations, last year registered the smallest in the history of the industry; it was less than half the net increase in 1921, despite the acute depression.

The present review completes 10 years of progress. The first one was published in THE IRON AGE, July 1, 1913. In that compilation only 19 furnaces were listed in the American industry. The review which follows shows that the total has expanded in 10 years to 406 furnaces or about 2000 per cent. The tenth anniversary of the attempt to canvass this new and important industry reveals the fact that America has passed the 400 mark in furnace installations.

The first review of this nature was made by the German paper, *Stahl und Eisen*, which was enlarged upon by THE IRON AGE in its issue of April 14, 1910; commencing with the annual review issue of THE IRON AGE of 1915, this analysis has appeared each year in that issue. The following review gives as complete and as accurate a statement of fact as it is possible to obtain. In one or two important cases no data were obtainable from the sellers of the furnace, but it has been possible to secure fairly reliable information from other sources. While the results in all cases are not so definite as THE IRON AGE would like to publish, the data are fairly representative and authentic, and are believed to cover the subject adequately.

Furnace Installations in the United States and Canada

THE net increase in the number of electric furnaces in the United States in 1922 has been 18 against 32 in 1921; 33 in 1920; 36 in 1919; 54 in 1918; 97 in 1917; 63 in 1916; 32 in 1915, and 22 in the period from July 1913 to Jan. 1, 1915. The total on Jan. 1, 1923, was 406 as compared with 388 on Jan. 1, 1922. The apparent net increase is less than the actual new sales or installations, owing to the passing out of existence of a furnace here and there. The following table shows the number of furnaces credited to the United States and Canada at the first of each review:

	U. S.	Canada		U. S.	Canada
July 1, 1913..	19	3	Jan. 1, 1919..	287	43
Jan. 1, 1915..	41	2	Jan. 1, 1920..	323	40
Jan. 1, 1916..	73	8	Jan. 1, 1921..	356	43
Jan. 1, 1917..	136	19	Jan. 1, 1922..	388	50
Jan. 1, 1918..	233	36	Jan. 1, 1923..	406	50

The expansion in the United States last year was confined largely to the sales of two types of furnaces—the Moore (or Pittsburgh) and the Greene. In Canada the industry was actually at a standstill, the loss of one furnace being offset by the gain of another.

The principal gain last year in this country was made by the Pittsburgh Electric Furnace Corporation, Pittsburgh, which swelled its total to at least 53 furnaces. With no official data from this company this figure is an estimate. The past year has been an extremely successful one for that company with about three times as many furnaces sold as in 1921. It is not possible to publish a detailed list of these installations. The latest sales of these furnaces include one each to the following companies: Bonney-Floyd Co., Columbus, Ohio; Dayton Steel Foundry Co., Dayton, Ohio; Bayonne Steel Casting Co. (probably the Eastern Steel Castings, Newark, N. J.), Bayonne, N. J.; the Blackwood Electric Steel Castings Co., Parkersburg, W. Va., and the Pittsburgh Valve Foundry & Construction Co., Pittsburgh.

In the table of Greene electric furnaces, besides the

Table of Greene Electric Steel Furnaces Installed or Contracted for in the United States and Canada, Jan. 1, 1923, as Sold by the Greene Electric Furnace Co., Seattle, Wash.

Company and Location	Size, Tons	No. of Furnaces	Product
Columbia Steel Co., Portland, Ore.	2	1	Steel
Eagle Brass Co., Seattle, Wash.	⅛	2	Iron, steel monel
Greene Shaw Co., Berkeley, Cal.	½	1	Iron and steel
Dayton Malleable Iron Co., Dayton, Ohio	2½	1	Iron and steel
Everett Steel Co., Everett, Wash.	¾	1	Steel
Hanford Iron Works, San Bernardino, Cal.	2	1	Steel and iron
Lamb Machine Co., Hoquian, Wash	1½	1	Steel and iron
Los Angeles Foundry Co., Los Angeles, Cal.	1½	1	Iron
Joplin Steel & Malleable Co., Joplin, Mo.	3	1	Steel
Olympic Steel Works, Seattle, Wash.	1	1	Steel
Olympic Steel Works, Seattle, Wash.	2½	1	Steel
Pacific Car & Foundry Co., Renton, Wash.	1½	2	Steel
Standard Brake Shoe & Foundry Co., Pine Bluff, Ark.	2	1	Steel
Skagit Steel & Iron Works, Sedro Woolley, Wash.	1½	1	Steel and iron
Skagit Steel & Iron Works, Sedro Woolley, Wash.	¼	1	Steel and brass
Tennent Steel Casting Co., Tacoma, Wash.	½	2	Steel
Tennent Steel Casting Co., Seattle, Wash.	2	1	Steel
Vulcan Mfg. Co., Seattle, Wash.	1½	1	Steel and iron
Southern California Edison Co., Aubeny, Cal.	¾	1	Steel and iron
Vaughan Motor Works, Portland, Ore.	½	1	Steel
Pacific Car & Foundry Co., Renton, Wash.	½	1	Special steels
Canadian Klondike Mining Co., Dawson, Y. T.	3	1	Steel
Circulating Type Induction*	...	2	Steel and iron

Total in the United States, including Alaska, 27.

Tarnay Brothers, Budapest, Hungary, have installed a 500-lb. Greene furnace for melting steel.

*Information concerning these special furnaces still unavailable.

Table of Volta Electric Steel Furnaces, Installed or Contracted for in the United States and Canada, Jan. 1, 1923, as Sold by the Volta Mfg. Co., Ltd. Welland, Ont., Canada

Company and Location	Size, Tons	No. of Furnaces	Product
United States:			
Union Electric Steel Co., Carnegie, Pa.	6	2	Steel
Canada:			
Hydro-Electric Commission, Chatham, Ont.	½	1	Steel or Gray Iron
Hiram Walker & Sons Metal Product Co., Walkerville, Ont.	1	1	Steel
Canadian Steel Foundries, Ltd., Montreal, Ont.	3	1	Steel
Dominion Foundries & Steel, Ltd., Hamilton, Que.	6	2	Steel
Electric Iron, Ltd., Lakefield, Ont.	6	1	Steel
Electro Foundries, Ltd., Orillia, Ont.	6	1	Pig Iron
Shawinigan Foundries, Ltd., Shawinigan Falls, Que.	5	1	Steel or Gray Iron
Turnbull Electro Metals, Ltd., St. Catherines, Ont.	6	1	Pig Iron
Port Moody Steel Works, Ltd., Port Moody, B. C.	6	1	Pig Iron
Lowox Steel Co., Ltd., Vancouver, B. C.	6	1	Pig Iron

Total in Canada, 11; in United States, 2.

The FitsGerald Laboratories, Inc., Niagara Falls, N. Y., has a 1-ton Volta furnace for making brass.

The T. Waddell & Sons Co., Ltd., Christchurch, New Zealand, has a 6-ton Volta furnace, Heroult type, for making steel.

Renton & Fisher, Ltd., Bathgate, Scotland, have a 3-ton Heroult type Volta furnace.

Two Volta furnaces are making ferrosilicon and ferrochromium for two Canadian companies.

Table of Heroult Electric Furnaces made by American Bridge Co., New York, and Installed or Contracted for in the United States and Canada up to Jan. 1, 1923

Company and Location	No. of Furnaces	Size, Tons	Products
Alaska-Treadwell Gold Mining Co., Treadwell, Alaska	1	2	Castings
American Manganese Steel Co., Oakland, Cal.	1	3	Castings
American Manganese Steel Co., Chicago Heights, Ill.	2	3	Castings
American Manganese Steel Co., Chicago Heights, Ill.	1	6	Castings
American Steel Foundries, Indiana Harbor, Ind.	1	6	Castings
Anniston Steel Co., Anniston, Ala.	5	6	Castings and Pig Iron
Armstrong, Whitworth of Canada, Ltd., Longueuil, Que.	1	3	Ingots
Armstrong, Whitworth of Canada, Ltd., Longueuil, Que.	3	6	Ingots
Atlantic, Gulf & Pacific Co., Manila, Philippine Islands	1	1	Castings
Atlas Crucible Steel Co., Dunkirk, N. Y.	1	3	Ingots
Atlas Crucible Steel Co., Dunkirk, N. Y.	2	6	Ingots
Baldwins Canadian Steel Corp., Ltd., Toronto, Can.	7	6	Ingots
Best Steel Castings Co., Oakland, Cal.	1	6	Castings
Bethlehem Steel Co., Bethlehem, Pa.	1	3	Castings
Bethlehem Steel Co., Bethlehem, Pa.	1	6	Ingots
Braeburn Steel Co., Braeburn, Pa.	2	6	Ingots
Buckeye Steel Casting Co., Columbus, Ohio	2	6	Castings
Carbon Steel Co., Pittsburgh, Pa.	1	6	Ingots
Carnegie Steel Co., Duquesne, Pa.	1	25	Ingots
Carpenter Steel Co., Reading, Pa.	4	6	Ingots
Clark Equipment Co., Buchanan, Mich.	1	2	Castings
Clark Equipment Co., Buchanan, Mich.	1	3	Castings
Connecticut Electric Steel Co., Inc., Hartford, Conn.	2	2	Castings
Crane Co., Chicago, Ill.	1	6	Castings
Crucible Steel Casting Co., Cleveland	1	1	Castings
Crucible Steel Casting Co., Lansdowne, Pa.	1	2	Castings
Crucible Steel Co. of America, Atha Wks., Harrison, N. J.	1	3	Ingots
Crucible Steel Co. of America, Atha Wks., Harrison, N. J.	3	6	Ingots
Crucible Steel Co. of America, Park Wks., Pittsburgh	2	6	Ingots
Crucible Steel Co. of America, Sanderson Wks., Syracuse, N. Y.	2	3	Ingots
Damascus Crucible Steel Casting Co., New Brighton, Pa.	1	2	Castings
Disston, Henry, & Sons, Inc., Philadelphia	1	3	Ingots
Disston, Henry, & Sons, Inc., Philadelphia	1	6	Ingots
Dominion Foundries & Steel, Ltd., Hamilton, Can.	2	6	Castings
Driscoll-Reese Steel Co., Hamburg, Pa.	1	1	Castings
Driver-Harris Co., Harrison, N. J.	2	2	Castings
Electric Alloy Steel Co., Charleroi, Pa.	2	6	Ingots
Electric Engineering & Foundry Co., Tacony, Pa.	1	1	Castings
Electric Steel & Forge Co., Cleveland	1	6	Ingots
Electric Steel Co. of Indiana, Indianapolis, Ind.	1	3	Castings
Electric Steel & Metals Co., Ltd., Welland, Can.	2	6	Ingots
Firth-Sterling Steel Co., McKeesport, Pa.	2	3	Ingots
Fort Pitt Steel Casting Co., McKeesport, Pa.	1	3	Castings
General Electric Co., Schenectady, N. Y.	1	5	Castings
General Electric Co., Schenectady, N. Y.	2	2	Castings
General Electric Co., Schenectady, N. Y.	1	1	Ingots
General Electric Co., West Lynn, Mass.	1	6	Castings
General Electric Co., Erie, Pa.	1	6	Castings
General Electric Co., Pittsfield, Mass.	1	1	Experimental Products
Halcomb Steel Co., Syracuse, N. Y.	1	4	Ingots
Halcomb Steel Co., Syracuse, N. Y.	3	6	Ingots
Harrow Spring Co., Kalamazoo, Mich.	1	6	Ingots
Heppenstall Forge & Knife Co., Pittsburgh	1	6	Ingots
Hess Steel Corp., Baltimore, Md.	6	6	Ingots
Hub Electric Steel Casting Co., Boston	1	2	Castings
Illinois Steel Co., South Chicago	2	15	Ingots
Illinois Steel Co., South Chicago	3	25	Ingots
Illinois Steel Co., Joliet, Ill.	1	4	Molten Ferro-Manganese
Latrobe Electric Steel Co., Latrobe, Pa.	1	3	Ingots
Latrobe Electric Steel Co., Latrobe, Pa.	2	6	Ingots
Lebanon Steel Foundry, Lebanon, Pa.	2	2	Castings
Lemoyne Steel Co., Monongahela, Pa.	1	2	Ingots
Llewellyn Iron Wks., Los Angeles, Cal.	1	3	Castings
Lorain Steel Co., Johnstown, Pa.	1	3	Castings
Lunkenheimer Co., Cincinnati	1	1	Castings
Michigan Steel Casting Co., Detroit, Mich.	1	6	Castings
Michigan Steel Casting Co., Detroit, Mich.	2	3	Castings
Midvale Steel & Ordnance Co., Nicetown, Phila.	1	6	Ingots
Millbury Steel Foundry Co., Millbury, Mass.	1	2	Castings
Milton Mfg. Co., Milton, Pa.	1	3	Castings
Milton Mfg. Co., Milton, Pa.	1	6	Castings
Milwaukee Steel Foundry Co., Milwaukee, Wis.	1	3	Castings
Monarch Foundry Co., Stockton, Cal.	1	1	Castings
National Malleable Casting Co., Sharon, Pa.	2	6	Castings
National Malleable Casting Co., Grant Wks., Chicago	3	6	Castings
National Malleable Casting Co., Cleveland	2	15	Castings
Newport News Shipbuilding & Dry Dock Co., Newport News, Va.	1	6	Castings
Oil Well Supply Co., Oil City, Pa.	1	2	Castings
Ontario Electric Steel Co., Fulton, N. Y.	1	1	Ingots
Ontario Electric Steel Co., Fulton, N. Y.	1	6	Ingots
Pennsylvania Engineering Wks., Newcastle, Pa.	1	6	Castings
Pettibone-Mulliken Co., Chicago	1	2	Castings
Racine Steel Casting Co., Racine, Wis.	1	3	Castings
Railway Steel Spring Co., Latrobe, Pa.	1	3	Ingots
Simonds Mfg. Co., Lockport, N. Y.	2	6	Ingots
Sizer Forge Co., Buffalo, N. Y.	2	10	Ingots
Southern California Iron & Steel Co., Los Angeles, Cal.	1	6	Ingots
Southern Pacific Co., Sacramento, Cal.	1	6	Ingots and Castings
Spencer Heater Co., Scranton, Pa.	1	3	Castings
Standard Seamless Tube Co., Economy, Pa.	1	15	Ingots
Standard Stoker Co., Erie, Pa.	1	2	Castings
Taylor, W. P., Co., Buffalo, N. Y.	1	2	Castings
Taylor-Wharton Iron & Steel Co., Highbridge, N. J.	1	3	Castings
Taylor-Wharton Iron & Steel Co., Easton, Pa.	1	6	Castings
Tennessee Coal, Iron & Railroad Co., Ensley, Ala.	1	6	Molten Ferro-Manganese
Timken-Detroit Axle Co., Canton, Ohio	1	2	Castings
Timken Roller Bearing Co., Canton, Ohio	4	6	Ingots
Treadwell Engineering Co., Easton, Pa.	1	2	Castings
Trojan Electric Steel Co., Chicago	1	1	Ingots
Tungsten Steel Co., Toledo, Ohio	1	¼	Cast Tool
Twin City Forge & Foundry Co., Stillwater, Minn.	1	3	Castings
Union Electric Steel Co., Carnegie, Pa.	3	6	Ingots
Union Spring & Mfg. Co., New Kensington, Pa.	1	6	Castings
United Alloy Steel Corp., Canton, Ohio	1	6	Ingots
United Alloy Steel Corp., Canton, Ohio	2	15	Ingots
U. S. Government, Watertown Arsenal, Watertown, Mass.	1	2	Castings
U. S. Government, Watertown Arsenal, Watertown, Mass.	2	6	Ingots
U. S. Government, Naval Gun Factory, Washington, D. C.	1	6	Castings
U. S. Government, Charleston, W. Va	3	6	Ingots
U. S. Government, Charleston, W. Va.	2	40	Ingots
U. S. Government, Charleston, W. Va.	1	1	Ingots and Experimental Products
Universal Steel Co., Bridgeville, Pa.	2	6	Ingots
Vanadium Alloy Steel Co., Latrobe, Pa.	2	3	Ingots
Vulcan Crucible Steel Co., Aliquippa, Pa.	2	3	Ingots
Warman Steel Casting Co., Los Angeles, Cal.	2	3	Castings
Warren Steel Casting Co., St. Louis, Mo.	1	2	Castings
Warren Steel Casting Co., St. Louis, Mo.	1	3	Castings
Washington Iron Works, Seattle, Wash.	1	3	Manganese Steel

Summary:

	Furnaces
Total in the United States, including Alaska and Philippine Islands	166
Total in Canada	15
Total in the United States and Canada	179

The International Nickel Co., Huntington, W. Va., has one 7-ton furnace, producing Monel metal.

additional sales of new furnaces, there have been several changes in the old installations. The Pacific Car & Foundry Co. bought the 1½-ton furnace formerly at the Capital City Iron Works, Olympia, and put it in operation for the first time. The Tennent Steel Casting Co. bought the Aurora Foundry Co.'s furnace and is operating it in Seattle. The Greene Electric Furnace Co. converted, by rebuilding, a furnace at the Vaughan Motor Works, Portland, Ore., formerly a Rennerfelt, into a Greene rolling cylinder furnace. The Greene new type of small furnace embodies a number of new improvements, in particular the combination of a new voltage control transformer making possible, it is claimed, the use of standard 220-volt, 3-phase current and affording a wide range of electrode voltage, doing away with the use of oil-filled transformers in the building and avoiding the necessity of a transformer room. The Greene furnace has invaded the foreign field by a sale to a company at Budapest, Hungary. Interesting information concerning the new Greene induction furnace is expected this year.

Two new contracts for the Heroult furnace have been made during the year: A 2-ton unit at the Oil Well Supply Co., Oil City, Pa., for steel castings, and a 3-ton furnace at the Washington Iron Works, Seattle, Wash., for manganese steel. Otherwise the American Bridge Co. reports the list unchanged.

A new design of electric steel arc furnace has been introduced to American users of such furnaces. Swindell & Brothers, Pittsburgh, announce the sale of a 2-furnace installation, each of 1½-ton capacity, to the Kelly & Jones Co., Greensburg, Pa., for the manufacture of steel castings. Credit for the design of these

Table of Greaves-Etchells Electric Steel Furnaces Installed or Contracted for in the United States on Jan. 1, 1923, as Sold by the Electric Furnace Consiruction Co., Philadelphia

Company and Location	Size, Tons	No. of Furnaces	Product
U. S. Navy Yards at:			
Norfolk, Va.	6		Castings
Puget Sound, Wash.	6		Castings
Mare Island, Cal	6		Castings
Charleston, S. C.	3		Castings
Philadelphia, Pa.	3		
Total		5	Castings
American Radiator Co., Buffalo, N. Y.	6	2	Castings
American Radiator Co., Buffalo, N. Y.	½	1	Castings
Halcomb Steel Co., Syracuse, N. Y.	3	2	Tool steel
Ford Motor Co., Detroit, Mich.	½	1	Castings
Ford Motor Co., Detroit, Mich.	3	1	Castings
Ford Motor Co., Detroit, Mich.	10	2	Steel
Ford Motor Co., Detroit, Mich.	50	1	Steel
Davidson Tool Mfg. Co., New York City	½	1	High speed steel
Hoskins Mfg. Co., Detroit, Mich.	½	1	Special
Sullivan Machinery Co., Claremont, N. H	1	1	Castings
Dodge Steel Castings Co., Philadelphia	3	1	Castings
Hammond Steel Co., Syracuse, N. Y.	3	1	Castings
Bird-Archer Co., New York		1	High speed steel
Brennan Steel Castings Co., Cleveland, O.	¼	1	Castings
Electric Steel Products Co., Turners Falls, Mass.	1	1	Castings
C. H. Wills & Co., Port Huron, Mich.	1	1	Refining iron
Wayne Steel & Iron Co., Pittsburgh	1	1	Castings
Wayne Steel & Iron Co., Pittsburgh	900 kva	1	Special
Vancouver Engineering Works, Vancouver, B. C.	1	1	Castings
Joliette Castings & Forgings, Ltd., Joliette, Que.	1	1	Castings

Total in the United States, 26; Canada, 2.

There have also been sold a ½-ton furnace to the Imperial Japanese Mint, Osaka, Japan; a 1-ton furnace to Brasilian Military Commission, and a furnace to the Sociedad Espanola de Construccion Naval, Madrid, Spain, for making ferroalloy.

Table of Rennerfelt Electric Steel Furnaces Installed or Contracted for in the United States, Jan. 1, 1923, as Sold by Hamilton & Hansell, Inc., New York

Company and Location	Capacity, Lb.	Product
American Foundry & Machine Co., Salt Lake City, Utah	6600	Castings
Best Steel Castings Co., Oakland, Cal.	2200	Castings
The Parsons Co., Newton, Iowa	2200	Castings
Pacific Foundry Co., San Francisco, Cal.	750	Pig iron
Chile Exploration Co., New York City	1000	Testing
Hamilton & Hansell, New York City	500	Special testing
Oklahoma Iron Works, Tulsa, Okla.	2200	Castings
Philadelphia Electric Steel Co., Conshohocken, Pa.	2200	Castings
Simonds Steel Co., Lockport, N. Y.	500	Testing
Liberty Steel Co., Morristown, N. J.	1000	Alloy steel
A. M. Byers Co., Pittsburgh	1000	Alloy steel
United States High Speed Steel & Tool Corporation	1000	Alloy steel
United States High Speed Steel & Tool Corporation	1000	Alloy steel
United States High Speed Steel & Tool Corporation	500	Alloy steel
Haynes Stellite Co., Kokomo, Ind.	200	Nichrome
Driver-Harris Co., Harrison, N. J.	300	Nichrome
Hardite Metals Co., Long Island City, N. Y.	1000	Nichrome
Morristown Electric Steel Foundry, Morristown, N. J.	1000	Steel castings

Total in the United States, 18.

furnaces is to be given to Frank W. Brooke, head of the electric furnace department of that company. These furnaces are planned to carry out a new method of electric melting, details of which will be published in a subsequent issue of THE IRON AGE. The firm also announces that it has sold several electric heat-treating furnaces for the heat treatment of steel, aluminum and special aluminum alloys.

The Booth Electric Furnace Co., Chicago, while furnishing no data as to its present installations for iron and steel, reports the introduction on the market of laboratory furnaces of various sizes from 1-lb. to

Table of Snyder Multi-Phase and Single-Phase Electric Steel Furnaces Installed or Contracted for in the United States and Canada, Jan. 1, 1923

Company and Location	Size, Tons	No. of Furnaces	Product
Snyder-Multi-Phase:			
Dayton Steel Foundry Co., Dayton, Ohio	5	1	Steel
West Steel Casting Co., Cleveland	5	1	Steel
Joyce-Cridland, Dayton, Ohio	3	1	Steel
Zimmerman Steel Co., Bettendorf, Iowa	5	1	Steel
Atlantic Foundry Co., Akron, Ohio	3	1	Steel
Interstate Foundry Co., Clearing, Ill.	5	2	Steel
Buckeye Traction Ditcher Co., Findlay, Ohio	1	1	Iron and steel
Hubbard Steel Foundry Co., East Chicago, Ind.	5	1	Steel
Niagara Elec. Steel Corporation, No. Tonawanda, N. Y.	1	1	Steel
Western Crucible Steel Cast. Co., Minneapolis, Minn.	3	1	Steel
The Denver Rock Drill Mfg. Co., Denver, Col.	¾	1	Steel
Industrial Steel Casting Co., Toledo, Ohio	2	1	Steel
Standard Steel Casting Co., Cleveland, Ohio	3	1	Steel
Chicago Steel Foundry Co., Chicago	3	1	Steel
W.K.Henderson Iron Works & Supply Co., Shreveport, La.	1½	1	Steel
Snyder Single-Phase:			
Crucible Steel Casting Co., Milwaukee, Wis.	1	1	Steel
Dayton Steel Foundry Co., Dayton, Ohio	1	1	Steel
S. Fair & Son, Saginaw, Mich.	¾	2	Steel
Western Crucible Steel Casting Co., Minneapolis, Minn.	1	1	Steel
Monroe Steel Casting Co., Monroe, Mich.	1	1	Steel
Sivyer Steel Casting Co., Milwaukee, Wis.	1	1	Steel
Otis Elevator Co., Buffalo, N. Y.	5	1	Steel
Minneapolis Elec. Steel Cast. Co., Minneapolis, Minn.	¾	1	Steel
Gerlinger Steel Casting Co., Milwaukee, Wis.	¾	1	Steel
Amer. Well & Prospecting Co., Corsicana, Texas	¾	1	Steel
Otis Elevator Co., Buffalo, N. Y.	5	1	Steel
Haynes Stellite Co., Kokomo, Ind.	⅔	3	Stellite
Chile Exploration Co., New York, N. Y.	3&1	2	Steel
Davidson Mfg. Co., Montreal, Canada	1	1	Steel
Electric Steel Co., Chicago, Ill.	1	1	Steel
Gerlinger Steel Casting Co., Milwaukee, Wis.	1	1	Steel
Manitoba Steel Foundry, Selkirk, Manitoba, Can.	1	2	Steel
New London Ship & Engine Co., Groton, Conn.	1	1	Steel
Stearnes Rogers Mfg. Co., Pueblo, Col.	¾	1	Steel
Electric Steel Co., Chicago, Ill.	3	1	Steel
Fairbanks Steam Shovel Co., Marion, Ohio	1	1	Steel
Beaumont Iron Works, Beaumont, Texas	1	1	Iron and Steel
W. K. Henderson Iron Wks. & Supply Co., Shreveport, La.	¾	1	Steel
United Alloy Steel Corp., Canton, Ohio	1	2	Alloy Steel
Western Steel Car & Foundry Co., Hegewisch, Ill.	1	2	Steel
Oil Well Supply Co., Oil City, Pa.	¾	1	Steel
Fluid Compressed Steel Co., Keokuk, Iowa	1	1	Steel
Industrial Steel Castings Co., Toledo, Ohio	2	1	Steel
H. Lifenitz Brass Foundry & Machine Shop, Indianapolis, Ind.	⅗	1	Steel

Tota in the United States, 51; Canada, 2.

300-lb. capacity which have sold rapidly; also the melting of gray iron borings in the Booth rotating furnace at a reasonable cost with the production of high grade castings.

No data was obtainable from the Repel-Arc Furnace Co., Indianapolis, Ind., which has several important units of small size operating on a commercial basis. The Grönwall-Dixon installations are reported as unchanged.

Minor changes in the industry include the following:

The Niagara Electric Steel Co., North Tonawanda, N. Y., discontinued the use of and dismantled its ¾-ton

Table of Electric Steel Furnaces Installed or Contracted for in the United States and Canada, Jan. 1, 1923, other than the Heroult, Snyder, Rennerfelt, Gronwall-Dixon, Greaves-Etchells, Greene and Booth Types

Company and Location	Size, Tons	No. of Furnaces	Type
Bethlehem Steel Co., South Bethlehem, Pa.	10	1	Girod
Washington Iron Works, Seattle, Wash.	3 & 1	2	Girod
Electric Steel Foundry, Portland, Ore.	1	2	Girod
Washington Steel & Ordnance Co., Washington, D. C.	1	1	Stassano
American Iron & Steel Mfg. Co., Lebanon, Pa.	20	2	Induction
General Electric Co., Pittsfield, Mass.	2	1	Induction
Ludlum Steel Co., Watervliet, N. Y.	10	3	Ludlum*
Metal Alloys, Inc.	5	3	Ludlum
Hammond Steel Co., Syracuse, N. Y.	10	1	Ludlum
McCord Mfg. Co., Chicago	6	2	Ludlum
American Cast Iron Pipe Co., Birmingham, Ala.	6	1	Ludlum
Omaha Structural Steel Works, Omaha, Neb.	2	1	Ludlum
Westinghouse Electric & Mfg. Co., Trafford, Pa.	6	1	Ludlum
Bonney-Floyd Co., Columbus, Ohio	3	1	Ludlum
Moreland Motor Truck Co., Burbank, Cal.	½	1	Ludlum
Old Dominion Iron & Steel Corporation, Richmond, Va.	3	2	Webb
Hercules Steel Casting Co., Milwaukee, Wis.	8	1	Vom Baur†
Moreland Motor Truck Co., Los Angeles, Cal.	3	1	Vom Baur
Moreland Motor Truck Co., Los Angeles, Cal.	½	1	Vom Baur
Rhode Island Crucible Steel Co., Providence, R. I.	1½	1	Vom Baur
Nitrogen Corporation, Providence, R. I.	¾	1	Vom Baur
Michigan Steel Castings Co., Detroit, Mich.	1	1	Detroit
Homestead Valve Mfg. Co., Homestead, Pa.	1	1	Detroit
Russell Wheel & Foundry Co., Detroit, Mich.	1	1	Detroit
Kelly & Jones Co., Greensburg, Pa.	½	2	Swindell
Onondaga Steel Co., Syracuse, N. Y.	1	1	Special
Chrome Steel Works, Chrome, N. J.	1	1	Special
Tivani Electric Steel Co., Belleville, Ont.	3	1	Special
Thos. Davidson Mfg. Co., Montreal, Que.	8	4	Special
Thos. Davidson Mfg. Co., Montreal, Que.	1½	1	Special
Canadian Electric Steel, Ltd., Montreal, Que.	7	3	Heroult modified
Canadian Brake Shoe Co., Sherbrooke	2	3	Special
Hull Iron & Steel Foundries, Ltd., Hull	6	1	Heroult modified
Baldwins Canadian Steel Corporation, Toronto	3	1	Heroult modified
Canada Electric Castings Co., Ltd., Orillia	1½	1	Special
Manitoba Steel Foundries, Ltd., Winnipeg	2	2	Special
Opsal Steel Co., Vancouver, B. C.	2½	1	Special
Shipton Electric Pig Iron & Steel Co., Ltd., Vancouver, B. C.	1	1	Special
Other special furnaces, estimated		5	Special

Total in United States and Canada: Girod, 5; Stassano, 1; Induction, 3; Ludlum, 14; Webb, 2; Vom Baur, 5; Detroit, 3; Swindell, 2; Special and Heroult modified, 26. *Total*, 61.

*A Ludlum 3-ton furnace has been sold to the Consolidated Rolling Mills & Foundry Co., Inc., New York, for installation in Chile. There are also 9 Ludlum furnaces of special type making various ferroalloys for the Metal Alloys, Inc., Watervliet, N. Y. The Andes Electin Corporation, Coney Island, N. Y., also is using a special 3-phase Ludlum furnace for smelting tin ores.

†Four Vom Baur furnaces have been sold for installation in Japan, one 6-ton furnace to Le Flaive et Cie., St. Etienne, France, and one 3-5 ton furnace to Consolidated Rolling Mills & Foundries Co., Mexico City, Mexico, for castings.

Snyder furnace and is now operating only the 1-ton multi-phase unit.

The Pelton Steel Co., Milwaukee, sold its 3-ton Snyder furnace to the old Fluid Compressed Steel Co. at Keokuk, Iowa, which has changed its name to the Keokuk Steel Castings Co., which now has to its credit two 1-ton furnaces.

The Standard Steel Casting Co., at Clearing, Ill., is now known as the Interstate Foundry Co.

Table of the Number of Electric Steel Furnaces in the United States and Canada

Type	U.S. Jan. 1, 1923	Canada, Jan. 1, 1923	U.S. & Canada, Jan. 1, 1923	U.S. & Canada, Jan. 1, 1922	U.S. & Canada, Jan. 1, 1921	U.S. & Canada, Jan. 1, 1920	U.S. & Canada, Jan. 1, 1919	U.S. & Canada, Jan. 1, 1918
Heroult	166	15	181	179	177	170	163	146
Snyder	51	2	53*	54	54	49	48	35
Rennerfelt	18	0	18*	18	17	18	13	13
Greaves-Etchells	26	2	28	28	25	18	11	12
Grönwall-Dixon	11	1	12	12	12	13	13	12
Ludlum	14	0	14*	13	13	12	11	6
Girod	5	0	5	5	5	5	5	5
Booth	10	0	10*	14	14	12	11	4
Moore (Pittsburgh)	52	1	53*	36	24	20	12	4
Induction	3	0	3	3	3	3	3	3
Webb	2	0	2	2	2	2	2	2
Stassano	1	0	1	1	1	1	1	1
Greene	27	0	27	23	13	11	8	1
Vom Baur	5	0	5	6	5	4	2	0
Wile	0	0	0	0	0	0	0	1
Detroit	3	0	3	3	1	1	0	0
Volta	2	11	13	13	8	...	...	...
Swindell	2	0	2	0	0	0	0	0
Special, etc †	8	18	26	28	20	24	27	24
Total	406	+ 50	= 456	438	399	363	330	269

*No offi

The Washington Steel & Ordnance Co., Washington, having been discontinued, it has been impossible to learn what has become of its Stassano furnace. This is therefore left on the list for the present.

The special furnace credited to the Hesse-Martin Iron Works, Portland, Ore., is no longer in existence, having proved unsatisfactory.

Installations in iron foundries and in manganese steel casting plants continue to increase which, with the establishing and expansion of electric steel foundries, constitutes the character of the year's trend in the industry. For the first time in some years, no large units have been sold. That the large furnace has a rôle to play is generally conceded.

Production of Steel in Electric Furnaces

In production, the American electric furnace industry in 1922 of course did not establish a record. While no data are at hand on which to base an estimate of last year's output, indications point to a total not far from that of 1919 and larger than that of 1921. Electric steel foundries were quite active the latter part of the year and it is probable that the electric steel casting output, as in 1921, will exceed that of electric steel ingots. The largest electric steel furnaces in the country were shut down last year, because of the closing of the naval ordnance plant at Charleston, W. Va., and no steel has yet been made in the 50 to 60 ton furnace of the Ford Motor Co. at Dearborn, Mich.

The following table contains the electric steel output of the United States since statistics have been gathered by the American Iron and Steel Institute:

Year	Ingots	Castings	Total
1909.....	13,456	306	13,672
1910.....	50,821	1,320	52,141
1911.....	27,227	1,878	29,105
1912.....	14,147	4,162	18,309
1913.....	20,973	9,207	30,180
1914.....	15,458	8,551	24,009
1915.....	46,348	23,064	69,412
1916.....	126,048	42,870	168,918
1917.....	239,632	64,911	304,543
1918.....	403,068	108,296	511,364
1919.....	272,942	111,510	384,452
1920.....	346,956	155,196	502,152
1921.....	84,404	85,095	169,499

The interesting fact which these data show is the steady growth of the electric steel casting industry. At 85,095 tons in 1921, the output was nearly four times the production for all the years preceding the war. For the first time it exceeded the electric steel ingot production. A large part of this expansion has been due to the increased demand for electric alloy steel castings. In 1921 the percentage of electric alloy steel castings of the total electric alloy steel made was 15.94 per cent as compared with 6.50 per cent in 1920 and 1.13 per cent in 1910.

In Canada the entire steel industry passed through a year of depression in 1922. Electric, like other steel output, was small. The striking fact, however, is that for the 11 months ended with November, almost half the steel casting output of the country was made in electric furnaces. This is true of no other country.

Concerning 1923, estimates of developments in new installations and output are almost impossible. Undoubtedly the poor showing made in new installations last year as compared with 1921 was due to the depression in 1921. Contracts made in the false boom of 1920 showed on the books in 1921 while the depression in 1921 had its effect last year. A prosperous year in 1923 may mean a large addition to the number of furnaces. There are those who incline to the opinion that the American industry has reached a state of stability in which the increase both in furnace installations and in production will not soon again show the expansions registered in the last 10 years.

The World's Electric Steel Industry

In THE IRON AGE Sept. 14, 1922, an article was published covering the world production of steel in electric furnaces. The data there presented in detail showed a large expansion in the 9-year period from 1913 to 1921. With Germany, Sweden and Austria-Hungary missing, the output of the leading countries in 1921 of 377,900 tons was over twice that in 1913 when it was 168,673 tons. Doubtless the 1922 record will surpass that of 1921 and approximate the record made in 1919 of 663,800 tons.

No attempt has been made in this review to compute in detail the electric furnace installations in other countries than the United States and Canada. The last analysis of this nature appeared in THE IRON AGE, Jan. 6, 1921. This showed total installations in the world outside the United States and Canada to be about 562 furnaces. Since then expansion in Italy has been large with the total increased to 180. With the 406 furnaces in the United States and the 50 in Canada on Jan. 1, 1923, and allowing for a moderate increase in that of other countries outside of Italy, it is not unreasonable to estimate the world's total installations a close to 1175.

The first review of this industry, published July 10, 1913, showed 121 furnace installations outside the United States and Canada, or 140 in the world. Ten years of progress reveals an expansion of nearly eight and one-half fold, or from 140 to 1175—truly not believed possible 10 years ago. Then Europe had nearly six times as many furnaces as the United States; today Europe can lay claim to no more than about twice as many as in the American industry. In 1913 the United States produced less than one-fifth of the world's total electric steel; to-day the proportion is certainly one-half and possibly more.

Ten years ago, in writing of this industry, the statement was made that "signs are not wanting that the industry will soon make rapid strides for without doubt the high grade steel emanating from this source will probably be an important factor in solving some of the metallurgical steel problems of the present and future." To what extent this estimate has proved true, this review in a measure reveals.

Puddlers' Rate Advances

YOUNGSTOWN, Jan. 2.—Average price on bar iron shipments by mid-Western mills for the 60-day period ending Dec. 20, was disclosed as 2.20c per lb., at the bi-monthly settlement last week between representatives of the Western Bar Iron Association and the Amalgamated Association of Iron, Steel and Tin Workers. This compares with 1.95c two months ago.

In consequence of the advance, the tonnage rate for puddlers advances to $11.38 per ton for the January-February period, comparing with $10.12 paid in November and December. Finishers are advanced 8 per cent to 57 per cent above base. Under the present rates they are paid 44½ per cent above base.

The examination of sales sheets was conducted at the offices in Youngstown of the Republic Iron & Steel Co. James H. Nutt, secretary of the manufacturers' association, acted for employers, while M. F. Tighe of Pittsburgh, president of the Amalgamated Association, represented employees.

Iron Making Economies Developed in 1922

Feasibility of 700-Ton Per Day Plant—Production of 7 Tons Per Man—Handling Flue Dust and Utilizing Scrap—Selling Surplus Power

BY F. H. WILLCOX*

IN markets other than those of especially strong characteristics, an increasing proportion of "merchant" pig iron will probably come from blast furnace plants integrated either with coke works, steel works, or both. At such plants surplus blast furnace gas is sold as power to the associated works, or as fuel gas itself; the coke is used at lower cost by reason of credits from by-product gas sold to the steel works or city gas companies, and by sales of tar, coke braize and by-products; the hot metal is used direct, with no charges for casting, unloading, piling and loading and with considerable benefit accruing at the open hearth in time and length of heat.

The aggregate of credits against production cost is tremendous. Of course, the credits are technically placed against coke, pig iron and steel costs. The point is, however, that they are there, wherever charged, and if the need arises the operation can throw a considerable proportion of its pig iron tonnage on the market, and by virtue of the above credits, realize a profit in a market where very many merchant furnace plants cannot get by.

This is not at all a new development but nevertheless it is one not as widely realized as the obviousness of the situation would imply. There is, as a matter of fact and in the face of this situation, an actual scarcity of merchant furnace plants that can operate at a profit and meet the country's pig iron consumption demand at the price the country can afford to or will pay. This is not a sound position for steady markets, nor for steady operation, nor for the comfort of employees, managements and owners of merchant furnace plants, strong or weak.

A blast furnace plant is run to make money. To do this consistently over the next ten years (at many merchant and steel works furnaces) in the face of the wide divergency in the economic aspect of productive blast furnace capacity on the market, will demand foresighted management and planning on the part of many of those entrusted with the responsibility of securing profits. In the future, as in the past, profits are to be secured mainly by maximum tonnage, low fuel consumption, and minimum labor in handling raw materials, product and waste, to which may be added the necessity of securing tangible income from profit sources at present unutilized.

Few Furnaces Produce Seven Tons Per Man

To realize what may be done in the matter of labor economy, it may be stated that a few of our modern single furnace plants produce seven tons of pig iron per man employed on the plant, or to put it another way, these plants employ but 1.72 man-hours per ton of pig iron production. An extreme case, showing the existing divergency, is the production of 1.6 tons pig iron per man employed, or 6.2 man-hours per ton, at a going merchant plant. An interesting aspect of the extent to which labor may be eliminated is the fact that one of our most modern and largest blast furnace plants has a consumption of but 1.1 man-hours per ton iron.

The outstanding points at which labor may be considered are to be found in stocking and charging, in pig iron disposal and the power house. Single furnace plants are actually going at a 700-ton production rate with but two men in the stock house, four men in the cast house, three men in the boiler house and five men on ladles and pig casting machine. The relation between construction cost and labor costs is interesting when considering these labor reductions.

Costs of Handling

Stocking and charging equipment for a modern stack costs 22 per cent of the plant cost, and the cost of unloading, stocking and charging the raw materials is, at present wages, 14 cents per ton of iron. This is, in turn, about one-fifth of the total labor cost, or two-thirds of 1 per cent of the total cost of iron. As an extreme type of costliness in labor, certain going plants producing 200 to 250 tons employ 58 men for the unloading, stocking and charging at a cost per ton of $1.10. Such small tonnage plants with stocking and charging equipment averaging 8 per cent of plant cost, and labor charges in that department nearly ten times that of larger concerns, can least afford to cling to antiquated equipment.

The foregoing is typical of conditions where expenditures are required to put the plant in economical working condition. On the other hand, surprisingly small expenditures are required, in many instances, to realize gratifying labor savings. As an example, a considerable use of labor is the continual "picking up" of material, and it runs into a uselessly large proportion of the total labor charge at too many plants. A little of this is inevitable; a large amount can be stopped. Not a little time of the labor gang is spent in picking up ore and limestone dribbled from bin gates and scale car doors, and in wheeling it to the skip pit and dumping it; in handling coke and ash as salamanders, and in cleaning coke out of the skip pit, not to mention shoveling and wheeling coke braize. Too often, one to even three extra men are carried in the cast house to handle scrap and slag, to clean runners, to bring in tools, loam, clay, etc. Frequently two men are required to change stoves.

A good share of the riggers' and millwrights' time is spent in pushing a truck about the tracks with tools and materials for repairs and maintenance. As many as four excess men per turn are actually used in fighting to keep iron ladles clean, and to keep pig machine troughs, links, pins, wheels and molds in shape, and to clear away scrap. At the majority of plants where an attempt is made to keep clean, at least one man's equivalent labor is used every day to clean up flue dust about the yard, platforms, cast houses and power plant. Cleaning the furnace top, roofs, not to speak of cleaning stoves and boiler settings, is regular routine at too many plants, and will run all of two men per turn. Every bit of this is existent at any one of a number of single furnace plants.

Large Expenditures Not Required for Labor Economies

Quite too much emphasis has been incorrectly put upon the theorem that large expenditures are required to economize in labor. This is true when one changes from hand filling to mechanical charging. On the other hand, minor expenditures and a well-paid foreman, with

*Vice-president Freyn, Brassert & Co., engineers, Chicago.

the help of the master mechanic and chemist, can cut the power house labor in two. Or in building a new plant, an additional expenditure of $10 per horse power will halve the labor and increase the power output by half.

In the category of "pick-up" labor, the record of practice of the last three years on newly built plants shows that it is not, in any sense of the word, increased construction expenditures that essentially eliminate this class of excess man hours, but rather thoughtfulness in design and layout and care in choice of equipment and appliances. A great deal, which the limit of this discussion does not permit, should as a matter of fact and interest be said about the degree to which labor has been conserved by working into plant design the results of observation and analysis of excess labor sources. It is a subject too little considered but one in which study carries promise of being definitely helpful, and it is the most encouraging of any source to which we can look, outside of obtaining a large divisor for the labor charge by increased tonnage, for reduction in the number on the labor force.

Increasing Output of Existing Stacks

Now as to the matter of increasing the tonnage, it can be said that tonnage is of course the major source of profit and insofar as expenditures can be made to get tonnage, they will pay. The blast furnace stack and hot blast stoves cost 19 per cent of total plant cost, and these, with the class of stocking and charging equipment carried by the 22 per cent expenditure mentioned, largely determine the tonnage, the human factor aside. Within the physical limits of the existing steel shells of the furnace stack and hot blast stoves, something approaching modern industrial miracles are accomplished.

For instance, this year records a new brick lining in an existing furnace stack and its accompanying stove shells which resulted in the production of 2.85 tons pig iron per 100 cu. ft. of furnace capacity, instead of 1.82 tons prior performance. As another angle on the same situation, furnaces of 25,000 cu. ft. capacity average from 550 tons to slightly better than 700 tons per day on as nearly the same materials as can be expected. The tonnage increase is unmistakably, and in both cases cited, quite definitely due to the design of the furnace lines plus the presence of good heat equipment. There is room for very considerable increase in tonnage at a great many furnace plants simply by changes in lines within the limits of existing shells, accompanied by similar changes in stove shells to give better heats. The identical betterments in lines and heat equipment which are productive of tonnage betterment work for saving in coke consumption, sometimes in even greater rates than the corresponding tonnage betterment.

Soundness of Using Cheap Scrap

Not especially new, but certainly confirmed, is the soundness of using cheap scrap, up to the extent of 8 per cent of the pig iron production as a means of tonnage increase. It cannot be said to affect adversely the soundness of the pig iron, and charged as turnings and borings, it does not adversely affect the life of lining. It is, on the other hand, usually distinctly beneficial to the furnace. There is always excess shaft heat, which the scrap usefully utilizes, and further, the hearth efficiency is as a rule low. Less than 22 per cent of the heat developed in the hearth and bosh by hot blast combustion of incandescent coke is usefully represented in the outgoing slag and iron.

The introduction of scrap into the burden raises the hearth efficiency to as much as 30 per cent, lowers the quantity of heat passing up into the shaft, promotes indirect reduction and lowers the top temperature, thereby decreasing secondary combustion of coke. This may explain why scrap can so frequently be added to the burden without decreasing the ore charge, and why the furnace actually moves more smoothly and quickly. Both metallurgically and economically, the use of rational amounts of cheap purchased scrap is exceedingly well founded and should be among the standardized methods of augmenting the furnace tonnage.

Value of Closed Top Metal Ladle

Apparatus for the disposal of the products of the furnace, gas, slag and iron, cost but 12 per cent of total plant cost. This past year has confirmed the advantages of the enclosed or closed top metal ladle. The results are so definite as to life of lining—in excess of 60,000 tons per lining—and in respect to ability to consume their own, and in addition cast house, pig machine and mixed scrap, and thereby add from 2 to 4 per cent to the pig metal net tonnage and in conservation of labor, that replacement or conversion of old equipment of this character should be on the blast campaign program. In gas disposal matters the main advance has been the operation of high-set boilers with distinct gas combustion chambers at between 175 and 185 per cent of rating on cold clean gas. This is noteworthy in that it measurably reduces the cost of steam generating equipment per ton of pig iron production.

In slag disposal the main advance has been in pumping of granulated cinder to remote locations for fill. In flue dust disposal the main advance has been in entirely eliminating the dumping of the dust catcher, with its attendant dust cloud. Instead, the dust is continually removed through a small grizzly into a continuous screw conveyor where it is wet down. The eventual development in this line will undoubtedly be in the line of wetting or pugging the dust catcher dust with partially dewatered gas washer discharge water, or settling basin sludge, and delivering the product direct to a sintering or briquetting machine, all integral with the gas cleaning system. Recovery and recharging of old flue dust by this or similar means spells a reduction in loss, between theoretical and actual yield to less than 1 per cent, instead of more nearly 4 per cent present average for the country. This saving is on the order of 30 to 40 cents per ton of pig iron.

Single Furnace Plant as Power Seller

The subject is so full of a number of interesting things that cannot be brought out simply by mention that we may as well conclude by ignoring all but one most significant development. This is the now demonstrated feasibility of a single furnace plant producing, in addition to its own widely fluctuating load of 400 to 1700 kw., a steady output of such sustained characteristic that public service corporations can, with their most conservative point of view, utilize this cheap power source as a feeder into their service line, exactly as gas companies take by-product gas. The furnace company, generating the power entirely from surplus blast furnace gas and coke braize, can afford to sell it on the basis of equivalent coal fuel per kilowatt hour, and realize handsome profits. On plants producing from 600 to 700 tons of pig iron, sale of surplus power may net a credit of such magnitude as to entirely wipe out the cost above raw materials per ton pig iron.

1922's Contribution Summarized

The feasibility of a 700-ton per day furnace plant, the production of seven tons of pig iron per man employed, the cleanup of surplus "pick-up" labor, the practical elimination of scrap and flue dust losses, rational use of scrap, greater output per 100 cu. ft. furnace capacity, sale of high electric power output per ton pig iron, and fuel economy are betterments toward which the managements can plan for ensuing blast campaigns,

with precedents established and with the assurances that the savings against the production will always be at least 3 to 1 against the fixed charges against production accruing by reason of the expenditures undertaken, and finally, knowing that it all contributes to the stabilization of the pig iron market. This is exactly as much to the benefit of the producer as to the consumer.

British Iron Industry Had Hard Year

Pig Iron Improved by American Buying, and Prospects Are Brighter—Finished Products Faced Continental Competition

LONDON, ENGLAND, Dec. 15.—While the iron and steel trades of the United Kingdom have continued in a parlous state as far as manufacturers are concerned, the past year has shown some improvement over its predecessor. After the boom of 1920, makers faced a world-wide slump the following year, and prices of materials of all kinds came tumbling down. As a whole, however, costs did not fall in the same proportion, and it is these that have been the main obstacle to recovery, fuel in particular having had an upward movement. Pig iron prices with minor fluctuations fell about 8s. a ton in 1922, and a few additional furnaces have been started, but there are still a good number standing idle.

The year opened with Cleveland No. 3 g.m.b. at 100s. a ton, and Continental competition keen. In an effort to stimulate trade, the Ironmasters' committee immediately declared a 10s. cut, and as a result demand began to broaden and foreign competition eased off. Indeed, Continental buyers made good purchases here, while home buying was of a hand-to-mouth nature. Hopes of improvement, however, were not realized, and for the next few months trading was so dull that furnaces were compelled to decrease output, the engineers' dispute causing a complete falling off in the home demand for foundry iron. Toward the end of June, however, inquiries began to dribble in from America, and small sales of special iron, ferromanganese and spiegeleisen were made. In July the committee for fixing prices was dissolved, and after six years of control Cleveland pig iron became free for all destinations. Values immediately fell 2s., but business continued dull.

American Demand for Fuel and Iron

America then began to buy large quantities of coal and coke, thereby pushing up the fuel price, and the situation of pig iron makers was far from satisfactory. The following quarter, however, witnessed a strong demand for pig iron on American and Canadian account; forward contracts were made, and works quickly filled their order books, so that by the beginning of October it was almost impossible to buy Cleveland foundry for prompt dispatch. Prices were pushed up, and the higher prices were readily paid. Hematite was unaffected, and for the first time in the history of the trade became cheaper than foundry.

Eventually, however, the American demand for foundry iron was temporarily satisfied, and the market became weaker, but the year closes with prospects considerably brighter owing to large railroad and other projects under negotiation, and as a result more furnaces have already been put in blast. The Continental demand for fuel is now affected by the depreciation of exchanges, in relation to the pound sterling, and coke is considerably cheaper, so that pig iron makers are confident of decreased costs in the new year.

As regards finished iron and steel the high costs of production throughout the year prevented makers reducing prices to economic levels, and the bulk of the orders booked were taken at a loss. This is reflected in the uniformly unfavorable balance sheets recently published by some of the more important groups.

It will thus be seen that the position as far as makers are concerned has been precarious. Latterly, however, sentiment has improved as a result of the railroad managers' decision to relieve unemployment, and by the placing of a fair number of new orders for ships. All through the year the prevailing quiet in shipbuilding trade has been severely felt, furnishing as it does a large percentage of the orders for heavy steel. Rail makers have had to face continued competition from the Germans and Belgians, and although sometimes prepared to cut the price almost to the bone, have lost the business because of the high rail and ocean freights. In addition, the Disposal Board, preparatory to closing, is now releasing large quantities of second-hand material at very low prices.

American Coal Strike Helped British Exports

The Far Eastern markets have been practically lost to us, and it has been only because of the American coal strike that orders from Japan have come here once more. Quite a large tonnage has been moving in black sheets for that quarter, but ordinary merchant business has been and is still going to the cheapest sellers, the Continent, in spite of the uncertainty of deliveries. Tin plate is, of course, an exception. America and Wales are the only producers of importance, and throughout the year Wales has been able to hold her own in most markets.

Japan has bought largely from the United States, but lately more orders from that quarter have been coming here, while several hundreds of thousands of boxes of oil sizes have been placed in Wales by American interests, and Canada has been a large buyer of packing sizes.

The attempt to stabilize the market by agreement not to sell below a certain fixed price has met with some success, and some works have their order books in better condition than ever before. This minimum price has since been advanced a further 6d. basis, while tin plate bar makers are charging an extra 3s. 9d. a ton for January-March deliveries. In the home trade, several tin box makers, who bought at high prices and found little or no call for their products, have failed. Galvanized sheets have had a fair year on the whole, most markets, with the exception of Japan, having made steady purchases, but the Indian demand has been particularly disappointing. True, moderate sales have been made, but the tonnages involved have not been on anything like the pre-war scale.

Throughout most of the year prices have been rather stationary, but latterly values have been forced up as a result of the increasing costs of raw materials, chiefly spelter. In semi-finished steel, periods of Continental competition have been faced, but British makers on the whole have had good bookings, although at low prices. Now, however, the Continent seems to need all its supplies for its own consumption, and with few offers from that direction, British makers are able to command better prices.

New Iron and Steel Works Construction

Open-Hearth Capacity Completed Last Year the Smallest Since 1911; Projected Capacity Large—Blast Furnace Expansion Light

WITH one exception, last year was uneventful in open-hearth or blast furnace capacity completed and in new capacity under construction as the new year starts. In open-hearth capacity completed, 1922 made a new low record, but in new steel making capacity projected for completion in 1923, a large gain was registered over the plans at the beginning of 1922. It falls only a little short of the capacity in prospect on Jan. 1, 1920. New open-hearth capacity completed in 1922 was less than in any year since 1911.

In blast furnace expansion only a slight gain is recorded over the showing at the commencement of 1922, when the poorest record in at least 27 years was registered. The gain consists in two blast furnaces having been completed as compared with only one in 1921.

In new open-hearth capacity completed in any year, 1917 stands first with 97 furnaces finished in that year, with an estimated output of 4,326,500 gross tons per year. In new capacity projected and under way the record was 72 furnaces in 1916 having an estimated capacity of 4,515,000 tons per year. For 1922 the estimate is 227,500 tons annual capacity completed and 819,000 tons projected for completion in 1923. The maximum records in pig iron were 14 furnaces completed in 1917 and 25 furnaces under way in 1916. The analysis this year shows only 2 furnaces completed in 1922 and 2 projected for 1923.

New Open-Hearth Capacity in 1922

New open-hearth capacity completed in 1922 amounted to only 227,500 gross tons or the smallest since 1911. This compares with a similar estimate of 247,500 tons added in 1921, with 675,000 tons added in 1920, and with 625,000 tons in 1919. Compared with the war and even the pre-war years, 1912 and 1913, these records are exceedingly small. The largest number ever completed in one year was 103 in 1916.

The summary below shows 8 open-hearth furnaces completed in 1922 as compared with 8 in 1921; with 20 in 1920 and with 9 in 1919. The 1922 additions in the form of a table follow:

New Open-Hearth Furnaces Completed in 1922

	No. of Furnaces	Annual Capacity, Gross Tons
Independent companies	8	227,500
United States Steel Corporation	0	.....
Total	8	227,500

The additions to open-hearth capacity in 1922 were made by the following companies:

Mansfield Sheet & Tin Plate Co., Mansfield, Ohio, four 75-ton furnaces; Kansas City Bolt & Nut Co., Kansas City, Mo., one 50-ton furnace; Southern California Iron & Steel Co., two 35-ton furnaces, and National Foundry Co., Erie, Pa., one 25-ton furnace.

While the United States Steel Corporation did not add any new furnaces, it rebuilt six large furnaces at the Ohio works of the Carnegie Steel Co.

Open-Hearth Construction for 1923

For completion probably in 1923 there are 17 furnaces projected or under way. This compares with only 6 in 1922, with 15 in 1921 and with 22 in 1920. The largest number of furnaces ever projected for one year was 91 for 1916. The estimated capacity of the 17 furnaces projected for 1923 is 819,000 tons as compared with only 217,500 tons for the 6 furnaces scheduled for 1922, or the lowest on record. The peak of the movement for peace time conditions was 3,100,000 tons for 88 furnaces for 1913.

New installations contemplated for 1923 are scheduled for the following companies:

Bethlehem Steel Corporation, Maryland plant, Sparrows Point, Md., four 100-ton furnaces at plant No. 1 and one 200-ton tilting furnace at plant No. 2; Wisconsin Steel Co., Chicago, five 100-ton furnaces; Otis Steel Co., Cleveland, four 100-ton furnaces; Kansas City Bolt & Nut Co., Kansas City, Mo., one 50-ton furnace; Ohio Steel Foundry Co., Lima, Ohio, one 35-ton furnace, and Riverside Steel Casting Co., Newark, N. J., one 8-ton furnace.

The United States Steel Corporation, while not announcing the building of any new furnaces, has under way the re-building of two 75-ton furnaces at the Duquesne works of the Carnegie Steel Co.

Expressed in the form of a table the proposed new open-hearth capacity is as follows:

New Open-Hearth Furnaces Under Construction for 1923

	No. of Furnaces	Annual Capacity, Gross Tons
Independent companies	17	819,000
United States Steel Corporation	0	.....
Total	17	819,000

New Blast Furnace Construction

The record of additions to blast furnace capacity, charcoal furnaces not being included, was only slightly larger than the record reported in this review one year ago, which was the smallest since 1914. At that time only one furnace was completed in the year just ended, 1921, and only two were projected for 1922. On Jan. 1, 1923, the estimates show two furnaces completed and two projected for completion, probably this year.

The record in new furnaces completed in any one year was 9 in 1912 and in those projected for any one year was 25 for 1917.

Additions to blast furnace capacity recently have been very few. Only 3 furnaces were actually constructed in 1921 and 1922 and only 5 have been projected for 1921, 1922 and 1923.

The following table gives the details of new blast furnaces completed in 1922 and at present under construction:

Company	Completed in 1922	Under Construction or Projected
Witherbee-Sherman Co., Port Henry, N. Y.	1	..
E. W. Mudge & Co. (Claire No. 1), Sharpsville, Pa.	1	..
Hamilton Furnace Co., Hamilton, Ohio	..	1
American Coke & Chemical Co., Granite City, Ill.	..	1
Total	2	2

Estimates of capacity for the furnaces completed last year are 320,000 gross tons with 330,000 tons the estimated capacity of the two furnaces under way.

Several companies rebuilt or are rebuilding their furnaces adding slightly to their former capacity. Among them are Delaware River Steel Co., Chester, Pa., which rebuilt its stack enlarging the height and bosh, and the Cranberry Furnace Co., Johnson City, Tenn. The Steel Corporation rebuilt during the last year No. 3 Duquesne furnace of the Carnegie Steel Co., No. 2 National furnace of the National Tube Co., No. 1 Shoenberger furnace of the American Steel & Wire Co. and No. 1 Ensley furnace of the Tennessee Coal, Iron & Railroad Co.

The Steel Corporation

New construction completed during 1922 and that under way as of Jan. 1, 1923, by subsidiary manufactur-

ing companies of United States Steel Corporation, is as follows:

Carnegie Steel Co.

Completed

Edgar Thomson Works: Greenawalt sintering plant No. 2 at briquetting plant; 20-in. gas line in open-hearth department; six roll lathes for roll shop; eight straightening presses for finishing department of Nos. 1 and 2 mills.

Duquesne Works: Reconstruction of blast furnace No. 3 and stock yard; standard gage track scale for blast furnace department.

Homestead Works: Forced air installation on one furnace at open-hearth plant No. 3; equipping one boiler at 30-in., 42-in. and 128-in. mills to burn pulverized coal; lifting tables for 110-in. plate mill; 20-ton shear crane and 15-ton electric overhead traveling crane at 30-in. slabbing mill.

Carrie Furnaces: Three 850-hp. boilers and auxiliary equipment at blast furnaces Nos. 1, 2 and 5; three 1500-kw. step-up transformers and enlarging transformer station building.

McCutcheon Works: Combined machine shop, store room and oil house.

Ohio Works: Reconstruction of six open-hearth furnaces.

Mingo Works: Three new hot blast stoves at blast furnace. No. 2.

New Castle Works: Railroad connection between blast furnace No. 1 and steel mill.

Under Way

Duquesne Works: Reconstructing two 75-ton furnaces at open-hearth plant No. 2; three 125-ton ladle cranes, 16 ladles and reinforcing crane runway in pouring building of open-hearth plant No. 1.

Homestead Works: New charging floors, two charging machines and strengthening building at open-hearth plant No. 1.

Isabella Furnaces: 10-ton ore bridge and addition to ore-stocking facilities.

New Castle Works: 1300-ton hot metal mixer and extension to mixer building.

Farrell Works: Improving stock house facilities at open-hearth plant.

Clairton Works: 366 additional by-product coke ovens, with facilities for tar and ammonium sulphate recovery, benzol plant and gas booster station.

Illinois Steel Co.

Completed

South Works: Gas-engine driven electric power station.

Joliet Works: Rebuilding four batteries of ovens and regenerator walls at by-product coke plant, two additional units for oil-treating track bolts.

Milwaukee Works: Extending building and crane runway at 9-in. merchant mill No. 2.

Gary Works: 12-in. and 20-in. strip mills; enlarging coal storage yard.

Under Way

South Works: Electric motor drive for 90-in. and 132-in. plate mills; 300-ton hot metal iron mixer at No. 2 open-hearth plant.

Universal Portland Cement Co.

Completed

Buffington, Ind.: Installing ball mills in raw material building at mill No. 6.

Universal, Pa.: Additional clinker storage and handling facilities.

Under Way

Buffington, Ind.: Water filtering and softening plant to serve mills Nos. 3, 4 and 6.

Duluth, Minn.: Additional kiln and auxiliary facilities at mill No. 7; dust-collecting equipment in raw material building at mill No. 7.

Minnesota Steel Co.

Under Way

Duluth Works: Rod and wire mill; townsite extension and additional dwellings for employees.

Lorain Steel Co.

Completed

Johnstown Works: Electric steel foundry with four-ton electric furnace.

Under Way

Johnstown Works: Shop for building steel cars for mines and industries; transformer equipment to permit use of purchased electric power.

National Tube Co.

Completed

Lorain Works: Rebuilding blast furnace No. 4; slag crushing plant; 3300-kw. gas-engine driven electric generator for central electric light and power plant.

National Works: Rebuilding blast furnace No. 2; six automatic bar machines for coupling blanks.

Pennsylvania Works: Additional finishing equipment in No. 1 lap weld mill; motor-driven air compressor with auxiliary equipment; 200-ton standard gage railroad track scale.

Under Way

Lorain Works: New boiler house building, six 1500-hp. boilers and auxiliary facilities; 1000-kw. motor generator set at blast furnace blowing engine house; equipment for electro-galvanizing couplings.

National Works: Five hot-blast stoves for blast furnaces Nos. 3 and 4; continuous upsetting and threading unit for lap weld mill; tapping and recessing equipment for coupling department.

Pennsylvania Works: Coupling finishing equipment for manufacture of taper-tapped couplings; eight-spindle vertical tapping machine for 6-in. to 12-in. couplings.

Gary Works: Pipe mills, consisting of five butt weld mills, four lap weld mills and one seamless mill with auxiliary departments and shops.

American Steel & Wire Co.

Completed

Cuyahoga Works: New machine and electrical repair shop building, with equipment, and additional storehouse facilities.

Newburgh Steel Works: Strengthening charging floor in open-hearth department; charging cars and boxes for open-hearth department.

American Works: Additional pot annealing equipment.

Salem Works: Equipping wire mill, No. 1 nail mill and tumbler room with motor drive.

Anderson Works: Rebuilding north bench in wire mill and installing block-stripping devices.

Waukegan Works: Bull block for drawing coarse size wires; continuous copper wire drawing machine; five-ton billet handling crane.

Shoenberger Works: Rebuilding blast furnace No. 1.

Braddock Works: Additional cleaning house facilities and rearranging equipment; agitators and feeders for rod mill gas producers.

Trenton Works: Extension to rope shop and equipment to manufacture special rope for export.

Worcester, North Works: Continuous cold rolling equipment for flat wire; two additional electro-galvanizing units for flat wire and enlarging galvanizing building.

Worcester, Electric Cable Works: Extension to building, additional equipment and rearranging old facilities to modernize plant and to increase capacity of electrical cable department.

New Haven Works: Additional rope warehouse facilities.

Donora Steel Works: Improved cinder handling facilities for open-hearth department.

Donora Wire Works: Building and equipment to manufacture electric-welded concrete reinforcement.

Farrell Works: Two additional passes for No. 1 rod mill.

Under Way

Cuyahoga Works: Extending annealing building and additional annealing equipment for flat rolled material; additional water service lines for fire protection.

Rockdale Works: New rod handling system through wire mill dry house.

Waukegan Works: Billet conveyor in rod mill.

Rankin Works: Enlarging baker and extending wire mill.

Allentown Works: Four 600-hp. boilers with coal and ash handling system.

Worcester, South Works: New crane runway in scrap yard.

Worcester Electric Cable Works: Improvements in rubber mixing department.

Donora Wire Works: Three electric welded reinforcement machines and additional warehouse facilities.

American Sheet & Tin Plate Co.

Completed

Gary Works: Drinking water system for sheet mill.

New Philadelphia Works: Breakdown pickler and auxiliary facilities.

Wellsville Works: Breakdown pickler and auxiliary facilities.

Wood Works: 40-ton overhead traveling crane with 10-ton auxiliary crane in annealing and cold rolling department.

Under Way

Gary Works: Four cooling conveyors for hot mill.

American Works: New uniflow engine to drive hot mills

Dover Works: Coal and ash handling system for boiler house; equipping galvanizing plant to make flux finished sheets.

Farrell Works: Mechanical stokers for ten sheet and pair furnaces.

Various Works: Improvements are being made in the

coke tinning equipment at Gary, American, Laughlin, New Castle, Shenango, Pennsylvania, National and Farrell Works.

American Bridge Co.

Completed

Pencoyd Works: New cranes and crane runway over charging floor and pouring side in open-hearth department.

Ambridge Works: Dock and unloading crane.

Shiffler Works: Additional fabricating unit.

Tennessee Coal, Iron & Railroad Co.

Completed

Ensley Works: Rebuilding blast furnace No. 1; new hot blast stove at blast furnace No. 1.

Red Mountain Mines: Electric power transmission line from Fairfield to No. 4 mine, Muscoda; 75 air drills, water hammer type.

Docena Mines: New pumping station for mine water.

Under Way

Ensley Works: Six 834-hp. boilers for No. 1 steam plant; pulverizing coal plant with handling and storage facilities; motor drive for 28-in. mill.

Central Water Works: 8,000,000-gal. water recovery and cooling system.

Red Mountain Mines: 60 mechanical ore loading machines with auxiliary facilities.

Fairfield Steel Co.

Under Way

Steel plant: 11-in. merchant mill, steel foundry, wood car and repair shop.

By-product Coke Plant: Drying equipment for ammonium sulphate.

Bethlehem Steel Corporation

The subsidiary companies of the Bethlehem Steel Corporation report the following improvements and additions completed in 1922 and under way at the close of the year at their various plants.

Bethlehem Plant, Bethlehem, Pa.

Completed in 1922: Centrifugal casting machine for brass foundry; extension to 28-in. billet mill building; twin motor drive in 46-in. blooming mill; leanto at iron foundry; equipment for manufacture of tunnel segments at iron and steel foundries.

Under way: Converting No. 1 tempering plant into a roll foundry; additional furnaces for press and hammer forge; additional furnaces and tools for the tool manufacturing department; extension to drop forge building; installing steam hammers, upsetting machine and furnaces in drop forge; twenty (20) gas producers at open-hearth No. 2 extension to crane runway in structural yard.

Steelton Plant, Steelton, Pa.

Completed in 1922: Electric drive in 35-in. mill; 6-ton electric furnace in steel foundry transferred from Bethlehem Plant.

Under way: Electric door lift on five (5) furnaces at open-hearth department; extension of gas mains to open-hearth and forge departments.

Lebanon Plant, Lebanon, Pa.

Completed in 1922: Cooper shop and galvanizing department; five (5) automatic bolt head trimming machines; two (2) thread rollers; four (4) continuous tumblers; two (2) rotary bluing furnaces; knuckle press.

Under way: Installation of rivet and track bolt furnaces; bolt containers; six (6) pointing and threading machines; extensions to sintering and ore concentrating departments.

Maryland Plant, Sparrow's Point, Md.

Completed in 1922: Concrete anchorage at ore docks; coal crusher at open-hearth No. 2; coal crusher at 40-in. blooming mills; two (2) 96-in. resquaring shears; one (1) 44-in. resquaring shear for sheet mills.

Under way: Two (2) stands of cold rolls for sheet mills; foamite system for oil tanks; extension to open-hearth No. 1 consisting of four (4) 100-ton stationary open-hearth furnaces; crane equipment, etc.; one (1) pit crane for 40-in. blooming mills; erection of 100 bungalows; one (1) 200-ton lifting furnace at open-hearth No. 2; one (1) 60-in. galvanizing unit at sheet mills; one (1) gas driven electric generator set for power station; 48-in. gas mains from the blast furnaces to coke oven by-product building; fire sprinkler system for main office building; one (1) 10,000-kw. steam turbine with condensers and 2000-hp. boilers; concrete piling at ore docks; dredging ship channel at the ore docks; 18-in. edging mill for the 24-in. continuous mill.

Lackawanna Plant, Buffalo, N. Y.

Completed in 1922: Rebuilding gantry crane No. 8; changing crane No. 71; electric screw down mill No. 7.

Under way: Changes to power station No. 2; service mains to open-hearth No. 2; standard gage tracks; new quenching car and changes to elevator at coke ovens; coke screens at blast furnace; air washer at 32-in. rail mill; spacing table at No. 1 shop; two (2) welfare houses at coke ovens; twenty-five (25) side dump cars; construction of roads; eighteen (18) cinder cars and forty-two (42) cinder pots for open-hearths Nos. 1 and 2; fourteen (14) electric rivet heaters for bridge shops Nos. 1 and 2; eight (8) electric door hoists for open-hearths Nos. 1 and 2.

Mining and Other Properties

Bethlehem Chile Iron Mines Co., Chile—Under way: Two (2) 500-kw. generator sets in power house; third rail and trolley; three (3) 60-ton electric locomotives; fifteen (15) 50-ton side dump cars; twenty (20) 50-ton hopper bottom cars; one (1) 300-ton electric shovel; mine electrification; converting steam shovel into an electric shovel; additional mooring facilities in the basin dock.

Bethlehem Cuba Iron Mines Co., Cuba—Under way: Aerial tramway.

Cornwall Ore Banks Co., Cornwall, Pa.—Under way: Ore hoist; hoist house; switchboard; transformers and air compressor for No. 3 slope; crusher plant and ore storage system for No. 3 slope; locker and lavatory for No. 3 slope.

Of the coal properties, the Penn Mary Coal Co., Heilwood Division, Heilwood, Pa., completed in 1922, land, houses and mine cars; pump house, well and water lines to mine No. 9; transmission lines. At the Preston Division, W. Va., there were completed in 1922: Nine (9) mining machines, and there are under way: Five (5) mining machines, five (5) 5-ton locomotives and one hundred (100) mine cars. At the Finch Run Coal Co., W. Va., there is under way: One (1) 15-ton mine locomotive at mine No. 41; one (1) 15-ton mine locomotive at mine No. 42; four (4) 50-hp. coal cutting machines; buildings and mine equipment at mine No. 42. The Ellsworth Collieries Co., Ellsworth, Pa., completed in 1922 one hundred and fifty (150) steel mine cars, and has under way two (2) 60-hp. boilers for mine No. 51, and six (6) mining machines.

Among the transportation companies the Ore Steamship Corporation, New York, completed in 1922 three (3) steel combination ore and oil steamers, and has under way two (2) steel combination ore and coal steamers of about 20,000 d.w. tons each.

During the year Bethlehem Shipbuilding Corporation, Ltd., acquired by purchase the plant of Simpson Patent Dry Dock Co., located at Jeffries Point, East Boston. This plant, now called Simpson Dry Dock Plant, comprises three basin dry docks, a machine shop, a plate and shape shop, and other auxiliary departments necessary for ship repairs. Under way: Air compressors and six (6) nozel hammers.

Midvale Steel & Ordnance Co.

The following work has been completed during the past year at the different plants of the Midvale Steel & Ordnance Co.:

Cambria Steel Company, Johnstown, Pa.: Three hot blast stoves at No. 5 blast furnace; ore and limestone bins for blast furnaces Nos. 7, 8 and 9; relining Nos. 4, 6, 7 and 8 blast furnaces and three blast furnace stoves; two soaking pit furnaces at 40-in. blooming mill, Franklin plant; 148 coke ovens complete with by-product and light oil recovering apparatus and by-product plant for present coke ovens together with benzol plant for all coke ovens; 300 steel mine cars for rolling mill mine; townsite and 89 houses adjoining Johnstown City; removal of 1300-ton mixer from Franklin blast furnaces to open-hearth department; installation of six arc welding machines at Franklin car shop; purchase of limestone lands near Milheim and Aaronsburg; three 6-ton mine locomotives for Slickville mine; changes to bridge runway and boiler house at incline plane; two coke quenching cars; replacement of roof at wire mill boiler house; renewal of ore bins, pig machines, gas piping, etc., at Nos. 5 and 6 blast furnaces; ventilating shaft for Rosedale mine; erection of 20 houses at Slickville mine; changes for reclaiming water at Franklin open-hearth plant; new ore bridge at Franklin blast furnaces.

Coatesville Works: Relining of No. 1 blast furnace; extension to scrap yard crane runway at tube mill.

The principal additions, improvements and renewals under construction at the close of 1922 and to be completed in 1923:

Cambria Steel Co.: 8000-hp. modern boiler installation for Franklin plant; replacement of entire Franklin open-hearth roof; extension of car shop to increase output of standard cars and also for the manufacture of tank cars;

welding machines, drill presses and hoists for Franklin car shop; two wheel facing machines for wheel plant; replacing walls and roof of washery building at Franklin coke plant; further electrification of rolling mill mine; completion of Nos. 5 and 6 mines at Rosedale; three 10-ton mine locomotives, one mining machine and 200 steel mine cars for Rosedale mines; 16-in. water line from Gautier to Franklin plant; retaining wall and ore transfer car at Cambria plant; replacement of floor in shipping shed at wheel plant; installation of coke gas line Rosedale ovens to Cambria plant; limestone crushing and screening plant at Naginey quarries; two dry gas cleaners for blast furnaces Nos. 5 and 6; motor driven shear 14-in. mill.

Coatesville Works: Coke dust screening and loading equipment at blast furnaces; waste heat boilers for open-hearth department; roll lifting cylinder for No. 3 plate mill; extension of three bays at skelp mill yard; two coal-fired heating furnaces with waste heat for skelp mill; low-pressure water system at viaduct plant; replacing coal trestle at plate mill gas producers; new dam at viaduct plant; relining of No. 3 blast furnace; motor for driving scarfing rolls at skelp mill; new press for manufacture of brake drums.

Union Coal and Coke Company: Development of new mine near Marianna; link belt rotary dump, new fan and mechanical screening arrangement at Acme mine.

Nicetown Works: Stretcher and cooling bed on bar mill.

Otis Steel Co.

The Otis Steel Co., Cleveland, late in the year completed plans for rounding out its Riverside works into a complete steel-making plant, and began the construction of a steel plant which will have 4 100-ton open-hearth furnaces, a 40-in. blooming mill and a 24-in. sheet bar mill to manufacture billets, sheet bars and slabs for its plate, sheet and strip mill departments. The Otis company also began the construction of a hot and cold-rolled strip steel finishing department. This will be equipped with a 20-in. hot strip mill and 20 stands of cold rolls. The strip steel department will have an annual capacity of 80,000 tons. The company expects to have both the steel plant and strip mills in operation early in the summer.

Ashtabula Steel Co.

The Ashtabula Steel Co., Ashtabula, Ohio, last year completed its sheet steel plant which was placed in operation late in the summer. The plant has 5 roughing and 8 finishing mills driven by a 1600-hp. engine; 8 combination sheet and pair furnaces; a double continuous annealing furnace; two galvanizing pots, and a corrugating machine. The boilers and furnaces are fired with powdered coal. The plant has an annual capacity of 60,000 to 72,000 tons of sheets.

Trumbull Steel Co.

The Trumbull Steel Co., Warren, Ohio, added to its strip steel capacity last year by the completion and placing in operation of a 10-stand, 14-in. mill designed to roll intermediate sizes of bands, hoops and strips. This is an electrically driven continuous mill with a continuous furnace, heated by producer gas. It has four roughing, two intermediate and two finishing stands. Its capacity is 140 to 600 tons per day, depending on the size of the section rolled.

Mansfield Sheet & Tin Plate Co.

The Mansfield Sheet & Tin Plate Co., Mansfield, Ohio, early in the year completed its new steel plant for the manufacture of sheet bars for its sheet mill department. The plant is equipped with four 75-ton open-hearth furnaces, a 32-in., 3-high blooming mill and a 24-in. sheet bar mill and has a capacity of approximately 10,000 tons of sheet bars per month.

Follansbee Brothers Co.

Follansbee Brothers Co., Pittsburgh, last year practically completed and put into operation its new plant at Toronto, Ohio, consisting of:

Four 35-ton basic open-hearth steel furnaces.

One thousand-ton forging press, for the reduction of ingots to billets.

One sheet bar mill.

Ten sheet mills, with the accompanying gas producers, complete.

Boiler and electrical power plant, turbines, generator, etc., annealing furnaces, cold mills, etc.

The open-hearth department represents approximately 70,000 gross tons of ingots per annum. No new construction is planned for this year.

West Leechburg Steel Co.

West Leechburg Steel Co., Pittsburgh, is installing one 8-in., 4-stand, tandem cold rolling mill, one continuous pickling machine and a warehouse building, 280 ft. x 80 ft. During the present year the company contemplates adding a 4-stand, 16-in., tandem cold rolling mill, together with the necessary auxiliary equipment and annealing furnaces. Additions are also being made to the hot rolling strip steel capacity and this equipment is expected to be ready for operation about April 1, consisting of one 16 to 20-in. semi-finished mill consisting of 12 stands of rolls including edgers, tables, cooling bed, shears and coiling machines. This mill will be operated electrically by alternating current motors on the roughing end and direct current variable speed motors on the finishing end. The building to house this equipment will be about 750 ft. long x 120 ft. wide, having a 120-ft. x 40-ft. lean-to on one side. Two cranes will serve the mill proper and three cranes will operate in the warehouse, pickling department and billet yard. Two large continuous heating furnaces will supply the hot steel slabs. The pickling department will contain plunger type tubs operated mechanically. Plans have also been prepared for a new machine and electric shop, 160 ft. x 40 ft.

Apollo Steel Co.

The Apollo Steel Co., Apollo, Pa., last year completed the erection of two jobbing mills, four sheet mills, of which three sheet mills and two jobbing mills are now in operation. There is in process of erection, also, a new storage and sheet bar shed, approximately 320 ft. long and 80 ft. wide. This building is to contain a new extra heavy type bar shear and an overhead traveling crane. There has also been added during the year two new galvanizing pots and additional pickling equipment, as well as increased annealing capacity and the erection of an additional black warehouse.

Brier Hill Steel Co.

The Brier Hill Steel Co., Youngstown, Ohio, did not increase its capacity last year and has made no definite program as yet for 1923. It contemplates the erection of stripping mills and possibly tube mills, but this program has not yet been adopted.

Wickwire Spencer Steel Corporation

The Wickwire Spencer Steel Corporation, New York, at its Buffalo works installed an electric screw-down on its 34-in. blooming mill. It has also entirely rebuilt the quarry equipment with steel trestle for conveyor belt, concrete bins and also put in new crushing and screening equipment. The company has added new wire drawing capacity and has installed at Buffalo from the Worcester mills equipment for electric welded reinforcing fabric, helical springs and wire hoops. It has also built and installed for the "Off-'N'-On" Chain Co. complete equipment for making its automobile tire chains.

At the company's Palmer works there has been added new equipment for the manufacture of wire rope and there have been installed additional wire drawing machines.

At the company's Goddard works the capacity for cold-rolled flat steel has been increased and a new flat wire annealing department has been installed, as well as a department for the manufacture of tipping metal.

At the company's Wright works, Worcester, and at the Clinton Works, Clinton, additional wire cloth galvanizing units have been installed.

The Wickwire Mining Co. has opened the Cardiff mine and made the first shipment of approximately 20,000 tons last year. This mine is in the Iron River district and is equipped with concrete lined shaft, steel head frame, electric hoists, compressors and pumps, brick buildings on the surface, etc., of the most modern type.

The officers of the corporation have been centralized at 41 East Forty-second Street, New York.

National Enameling & Stamping Co.

The National Enameling & Stamping Co., Granite City, Ill., makes the following statement concerning new installations finished in 1922 and plans for 1923:

A sheet and jobbing mill unit, complete, consisting of 6 sheet mills and one 72-in. jobber.

Four galvanizing pots and all necessary equipment, including furnaces, etc., to be completed by July 1, 1923.

One 100-in. three-high tandem plate mill, with continuous slab furnace, soaking pits, etc., rolling from eight-gage to 1⅛ in. thick; it will be completed by Feb. 1, 1923.

One Morgan soaking pit charging crane.

One additional bay to be added to the soaking pit building.

New three-story executive office building, 88 x 40 ft., to be completed by July, 1923.

New machine shop, blacksmith and pipe shop building, 190 x 300 ft., to be completed by August, 1923.

Four 400-hp. Wickes waste heat boilers attached to the open-hearth building, completed December, 1922.

Inland Steel Co.

The Inland Steel Co., Chicago, did not add to its steel-making capacity last year and its program for 1923 has not yet been determined. Some improvements are contemplated. In 1922 the company increased its plate mill capacity approximately 50 per cent and practically doubled its capacity in track accessories such as tie plates, angle bars, bolts and spikes.

The company's 28-in., 3-high, 3-stand structural mill at plant No. 2, Indiana Harbor, Ind., was equipped so that it could roll rails as well as structural shapes. Rail production started early in 1922.

Jones & Laughlin Steel Co.

The Jones & Laughlin Steel Co., Pittsburgh, last year made no changes which in any way would affect the company's production of iron and steel, but a good deal of money was spent in installations connected with other than steel works and blast furnace operations. Its machine shop at the South Side works was rebuilt and the equipment was replenished. A new power house was built at the Eliza furnace. The company expects this year to remodel its 78-in. mill at the Soho Works and to make changes at the skelp mill at its Aliquippa Works.

Youngstown Sheet & Tube Co.

The Youngstown Sheet & Tube Co., Youngstown, Ohio, did not increase its capacity last year, but plans in the near future to replace its present universal skelp mill with a modern electrically driven mill. Last year the company electrified its sheet mills and rebuilt the furnaces at No. 2 skelp mill.

Wisconsin Steel Co.

The Wisconsin Steel Co., Chicago, is installing five 100-ton open-hearth furnaces and the necessary equipment to go with them. These furnaces the company expects to have in operation some time during the latter half of 1923.

Interstate Iron & Steel Co.

The Interstate Iron & Steel Co., Chicago, in 1922 made additions of furnaces and machinery and other equipment to its cold drawing and heat-treating plant at East Chicago, doubling the capacity of this department. At its South Chicago works it is installing a MacIntosh-Hemphill blooming mill shear together with transfer tables and necessary approach and shear tables. Completion of this improvement is expected early this year.

Kansas City Bolt & Nut Co.

Kansas City Bolt & Nut Co., Kansas City, Mo., completed in 1922 its second 50-ton open-hearth furnace and also finished and put in operation a Morgan continuous mill of four stands, a 10-in. merchant mill of five stands and an 8-in. finishing mill of two stands, with a capacity of 300 tons per day of finished bars, 2-in. round and smaller and 3-in. flats and smaller. The company is now considering the construction of a third open-hearth furnace.

Wheeling Steel Corporation

The Wheeling Steel Corporation, Wheeling, W. Va., expects to complete this year a 35-in. blooming mill and a 19-in. continuous mill at the La Belle Iron Works, both of which are really replacements, and will install a 10-in. continuous rod mill as a new unit at its plant at Portsmouth, Ohio. The foregoing improvements include also two generators, six gas producers, five boilers and 12 heating furnaces for the sheet mill.

Weirton Steel Co.

The Weirton Steel Co., Weirton, W. Va., made no changes in its plant during the past year, but this year has in course of construction 37 by-product ovens and 12 sheet mills, eight hot and four cold, both of which plants are expected to be operating during the first half of the year.

Southern California Iron & Steel Co.

The Southern California Iron & Steel Co., Los Angeles, Cal., recently erected two 35-ton open-hearth furnaces at its new site at Huntington Park, Cal. It expects to have these operating early in January and eventually to move all its present equipment from the old plant at Fourth and Mateo Streets to the new location. This work is progressing gradually so as not to interfere with current business.

John A. Roebling's Sons Co.

The John A. Roebling's Sons Co., Trenton, N. J., at its Roebling, N. J., works is constructing a hot strip rolling mill of 30,000 tons annual capacity, which will be completed early in 1923. This mill will replace an old mill at the Trenton works. A 12,000-hp. boiler plant is being equipped with stokers and coal and ash-handling machinery. During the past year scrap and billet handling equipment and a scull cracker were installed.

At the Trenton works a new electro-galvanizing plant for flat and round wire was completed last year. Machinery for wire drawing and rope making was increased and one wire mill and one rope shop were converted from obsolete engine drives to electric drives.

Newton Steel Co.

The Newton Steel Co., Newton Falls, Ohio, expects to place in operation during January eight additional sheet mills. The company already has a plant containing 10 sheet mills which, together with the addition referred to, will give the company a producing capacity of 18 sheet mills or approximately 100,000 tons of sheet annually. The greater part of the output will be in full finished sheets such as are used by the automobile and metal furnishing trades.

American Rolling Mill Co.

The American Rolling Mill Co., Middletown, Ohio, did not increase its capacity during 1922. The new capacity now under construction for 1923 is principally located at its new Ashland plant, where the company proposes to produce approximately 225,000 to 250,000 tons of sheets and light plates of special grades per year. This will be an addition to the present tonnage and will result in a total output of approximately 500,000 tons per year.

Other Steel Works Additions

The Gulf States Steel Co., Birmingham, Ala., last year increased its wire mill production by adding one 20-block small wire drawing frame and 31 new nail machines. There has also been built a steel and brick warehouse, 60 x 500 ft., for storing nails.

The Laclede Steel Co., St. Louis, Mo., at its Valley Works, East St. Louis, Ill., substituted a steel building for a wooden building over its forging plant and at its Madison Works, Madison, Ill., completed an addition of 500 ft. to the steel building constituting its warehouse.

The Firth-Sterling Steel Co., McKeesport, Pa., recently completed the erection of a modern research and heat-treating laboratory. The equipment includes the latest developments in heat-treating furnaces and metallographic and physical testing apparatus.

The Glasgow Iron Co., 603 Harrison Building, Phila-

delphia, with works at Pottstown, Pa., recently purchased the 96-in. plate mill, including machinery, buildings and everything pertaining thereto, which it sold to the Nagle Steel Co. some years ago.

The Heppenstall Forge & Knife Co., Pittsburgh, during 1922 installed 15 oil-fired heating furnaces of its own special design. These furnaces took the place of 20 coal-fired furnaces which had been in operation for some time. The new furnaces are equipped with air pre-heaters and Anthony oil burners.

The Atlantic Steel Co., Atlanta, Ga., last year replaced the steam engine on its rod and merchant bar mill with electric motors and installed a new 1500-kw. motor generator set in its power house.

The Atlas Crucible Steel Co., Dunkirk, N. Y., has ordered for erection during 1923 a 20-in., 2-stand, 3-high bar mill with tables and hot saw.

The Onondaga Steel Co., Inc., Syracuse, N. Y., installed last year an 18-in. cogging and finishing mill.

NEW ROLLING MILL WORK

Installations of new rolling mill capacity, outside of those plants having steel-making departments, in 1922, and that planned for 1923, are as follows:

Acme Steel Goods Co.

The Acme Steel Goods Co., Chicago, during 1922 made improvements in its billet heating furnace and in its continuous hot rolling mill so that it now produces 6000 tons of finished hoops per month. The company has installed 12 additional mills for cold rolling and increased its capacity for cold rolled light strip steel to 4000 tons per month. There has also been added an additional unit to the company's cold rolled galvanizing equipment for producing light galvanized cold rolled strip steel, adding 300 tons per month to the former capacity.

For installation in 1923 the company placed orders for cold rolling machinery for a large addition to its cold rolling capacity, which is now in the course of construction and which will give the company capacity to produce all thicknesses, widths, tempers and finishes of cold rolled strip steel from the narrowest widths to 20 in. wide. This additional wide strip capacity will increase the company's total cold rolled strip capacity another 5000 tons per month. It is expected that the annealing ovens and machinery will be completed about May 1. The mills are being built as an addition to the company's plant at Riverdale on the Calumet River, just south of Pullman, Ill.

At the company's Riverdale plant during 1922 there was completed one building, steel frame, with wood block floor, metal sash, 150 ft. wide by 60 ft. long. There is also being built two additional buildings each 400 ft. x 100 ft.

The new buildings for the addition to the cold rolled plant will consist of three steel frame buildings, one 500 ft. x 150 ft., with concrete walls, metal sash and wood block floor and with a crane covering the middle span of 50 ft. The other two buildings will be steel frame with roof and sides of corrugated iron, each 250 ft. x 70 ft., one covered by a 30-ton and the other by a 10-ton crane.

Other New Rolling Mill Work

The Manufacturers Iron & Steel Co., New Brunswick, N. J., is providing for the transfer of the manufacture of its horse shoe calk products from New Brunswick to the Bryden Horse Shoe Works, Catasauqua, Pa., and for the accommodation of this, a new concrete steel sash building 16 x 196 ft., one story high, is being erected with supplementary storage buildings and tempering plant. The company will retain its facilities at the New Brunswick plant for the manufacture of its machine-made products and for the development of new lines of products which are being considered.

The Calumet Steel Co., Chicago Heights, Ill., is installing an 18-in. heating mill consisting of one set of hoistings driven by a 400-hp. motor through a Falk reducing gear.

The Milwaukee Rolling Mill Co., Milwaukee, Wis., made no extensions to its equipment last year, but now has under construction two additional hot mills, two sheet and pair furnaces and one annealing furnace which will increase the plant to a 10-mill unit.

The Sellers Mfg. Co., Chicago, is changing its entire plant to oil heating, thereby discontinuing the use of coal. This transformation is expected to be completed early in 1923. No improvements to rolling mill capacity were made last year and none is contemplated for this year.

The Hoosier Rolling Mill Co., Terre Haute, Ind., has not yet completed its 20-in. mill but hopes to finish it during the present year.

The Wallingford Steel Co. of Wallingford, Conn., purchased from Lewis Foundry & Machine Co., Pittsburgh, last year, a 14-in. cold strip train with gear drives.

The Norton Iron Works, Ashland, Ky., plans to build during 1923 a new wire cloth plant with 200 looms.

BLAST FURNACE WORK

Witherbee, Sherman & Co., 2 Rector Street, New York, built during the year a new blast furnace at Port Henry, N. Y., with a capacity of 500 tons per day, the installation including four stoves, an additional strand on the present pig machine and the necessary turbine blowing equipment. It is expected that the furnace will be in operation early this spring.

The Pulaski Iron Co., Philadelphia, finished the erection last year of a Greenawalt sintering plant with complete equipment. It put into active operation its newly developed specular ore mines, work on which was brought to completion just before operations were stopped in 1920. The Pulaski blast furnace, after having been out of blast since late in October, 1920, resumed Nov. 9, 1922, after the longest shut-down in the history of the company's activities since 1888.

The Belfont Iron Works Co., Ironton, Ohio, added a new steel trestle for the storage of ore at its blast furnace department.

The American Coke & Chemical Co., Chicago, announces that it expects to build this year another 600-ton blast furnace at its plant at Granite City, Ill.

The Hamilton Furnace Co., Hamilton, Ohio, expects to complete its No. 2 furnace this year. The new blowing engine building and the foundations for the furnace are already completed. The company will also erect a by-product coke plant nearby.

Delaware River Steel Co., Chester, Pa., during 1922 rebuilt its blast furnace stack, increased its height to 85 ft., bringing the capacity up to 10,000 tons a month or 120,000 tons a year.

The Cranberry Furnace Co., Johnson City, Tenn., made repairs to its blast furnace consisting of a new lining, new hearth and bosh, new top and has equipped its blowing engines with plate valves with a view of beginning operations early this year. These improvements are expected to increase the output to some extent, which is expected to be about 45,000 tons per year.

Additions to Foundries

The Bucyrus Co., South Milwaukee, Wis., during the past year installed new equipment and rearranged old equipment, including the addition of one 300-ton hydraulic press; one sanitary sand blast; a 1½-ton electric furnace; two modern oil-fired annealing furnaces, 14 x 20 ft., and 11 x 22 ft. respectively; two mold drying ovens, 18 x 25 x 10 ft. each; one 8-ft. sand mill of the latest type; a large tumbling barrel, and two yard gantries, each having two trolleys of 10 tons capacity. The steel-making capacity of the company was increased last year approximately 175 tons per month. The capacity of the steel foundry at the close of 1922 was approximately 775 tons per month, but the company expects to complete its 1200-ton steel foundry in 1923 with the work now under way.

The National Foundry Co., Erie, Pa., added last year one 25-ton acid open-hearth furnace and made a 100-ft. extension to its main foundry building. These improvements give the company a steel casting capacity of 1200 tons per month. Last year the company also made extensive additions to its machine shop, including the building and equipment, and states that it is now in a position to bid on the complete manufacture of any ordinary sized machinery.

The Crucible Steel Casting Co., Cleveland, Ohio, has completed a new modern foundry building at Almira Avenue and West Eighty-fourth Street, and has installed practically all new equipment. The company expects that its present capacity will be increased two or three times in its new plant. It expects to have the new plant in operation this month.

The Eagan-Rogers Steel & Iron Co., Crum Lynne, Pa., last year added to its equipment a considerable number of molding machines and handling apparatus, and is about to install this year additional equipment of the same kind which, it is stated, will increase the production of the plant about 50 per cent.

The Riverside Steel Casting Co., Newark, N. J., has under construction a new 8-ton acid open-hearth furnace and has completed a new sand blast equipment, and proposes to install a new large car annealing furnace.

The Ohio Steel Foundry Co., Lima, Ohio, has under construction one 35-ton open-hearth furnace which it expects to complete April 1.

Canadian New Construction

The Dominion Iron & Steel Co., Ltd., Sydney, Nova Scotia, Canada, now part of the British Empire Steel Corporation, Ltd., did not increase its blast furnace, steel works or rolling mill capacity last year and does not contemplate any increase this year. It did add, however, to its producing capacity last year by the installation of a second wire galvanizing unit with an output of about 60 tons for 24 hr. This additional frame will be in operation about Jan. 15 and was installed to take care of additional demands for galvanized fence wire and barbed fencing.

The Steel Company of Canada, Ltd., Hamilton, Canada, has rebuilt its B blast furnace, which will have a capacity of about 450 tons per day. The furnace was to have been started about Dec. 20, 1922.

The Canadian Brake Shoe & Foundry Co., Ltd., Sherbrooke, Quebec, has under way some improvements to its plant which it is expected will increase its capacity about 50 per cent in 1923. The capacity at present is about 150 tons per month.

Marked Spread of Iron and Steel Pipe Prices

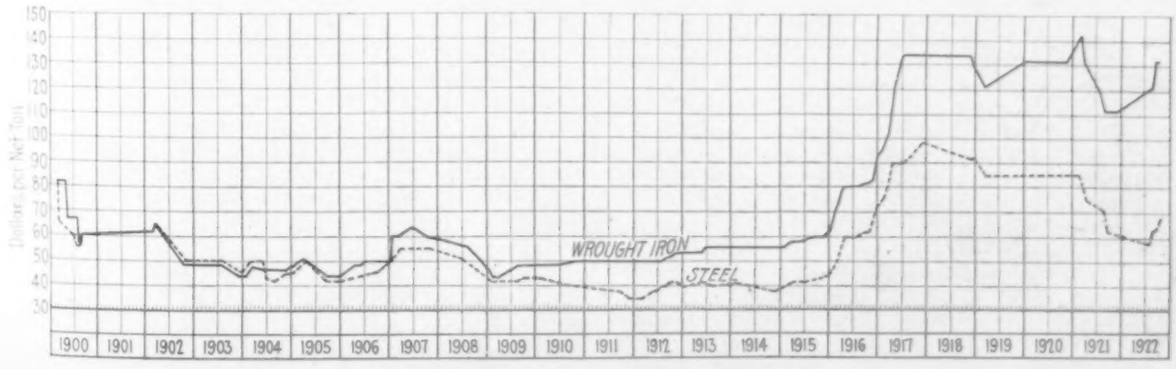
Tendency to Diverge More Decided Than Ever— Card Discounts Not Adhered to—Heavy Demand Due to Building May Not Continue

BY GEORGE F. TEGAN

TENDENCY of wrought iron pipe prices to draw away from those for wrought steel pipe again has been marked in the past year and the spread between the two kinds at the beginning of the new year was greater than ever before. In the early part of 1921, in the face of then existing depression, leading makers of wrought iron pipe came out with a discount card quoting the base sizes of black butt welded pipe at 29½ per cent off list, this being equivalent to a price of $141 per net ton, before the deductions of the supplementary discounts. At the same time, the card discount rate on the base sizes of steel pipe was 57½ per cent off list, equivalent to a price of $85 per net ton, prior to deductions of supplementary discounts. Thus, iron pipe was quoted at $56 a ton higher than steel pipe. Present prices are $132 per net ton for wrought iron and $68 for steel pipe, a difference in favor of the latter of $64 a ton, without reference to the extra discounts given on both classes of goods to large jobbers, which, being the same, do not decrease the spread between the two kinds. In 1922, steel pipe advanced $10 a net ton while iron pipe went up $21.

It is seriously doubted whether the two kinds of pipe really are competitive; indeed, it is a pretty frequent assertion of makers of steel pipe that wrought iron pipe is no more a competitor of steel pipe than is brass. It would seem to be a safe prediction, in view of the tendency of iron pipe over several years past to advance more than steel pipe, that as time goes on, it will find as little use in relation to steel pipe as cut nails now have in comparison with wire nails. Since the explanation for the high prices for iron pipe is found chiefly in costs, manufacture being largely hand work, only the discovery of some means of reducing costs, and in turn selling prices, will save it from falling into progressively more limited use. That such a situation is feared is proven by the efforts that are being made to perfect mechanical puddlers. Some success has been made in that direction, but evidently it is not of a pronounced character, since largest producers of iron pipe cling to the hand puddling method.

The past year has been marked by an exceptionally heavy demand for standard pipe, due to the very extensive building campaign which has been country-wide but has shown up particularly heavy in the cities, notably New York, Philadelphia and Chicago. The prices named by makers of steel pipe on Dec. 15, 1921, and by the wrought iron pipe makers as of Sept. 1, 1921, were not officially changed until Aug. 15, 1922, when there was an advance of $6 per ton in steel pipe by independ-



Wrought Iron and Steel Pipe Prices, 1900-1922

Date of Change	Steel Pipe Discount	Steel Pipe Dollars per Net Ton	Wrought Iron Pipe Discount	Wrought Iron Pipe Dollars per Net Ton
Feb. 21, 1900	59	82.00	..	....
Mar. 1, 1900	..	....	59	82.00
May 1, 1900	67	66.00	..	....
May 15, 1900	..	....	67	66.00
July 1, 1900	70	60.00	70	66.00
Aug. 1, 1900	72	56.00	..	....
Aug. 25, 1900	..	....	72	56.00
Sept. 1, 1900	70	60.00	70	60.00
Mar. 1, 1902	69	62.00	69	62.00
Mar. 15, 1902	67	66.00	67	66.00
Nov. 12, 1902	75	50.00	76	48.00
Mar. 16, 1903	..	....	76	48.00
Apr. 1, 1903	75	50.00	..	....
July 18, 1903	75	50.00	..	....
Aug. 1, 1903	75	50.00	..	....
Dec. 31, 1903	77	46.00	78	44.00
Feb. 1, 1904	76	48.00	..	....
Mar. 1, 1904	75	50.00	77	46.00
Mar. 12, 1904	..	....	76	48.00
June 1, 1904	..	....	77	46.00
July 1, 1904	78½	43.00	..	....
Sept. 3, 1904	79	42.00	..	....
Oct. 19, 1904	78	44.00	..	....
Nov. 1, 1904	77	46.00	..	....
Jan. 2, 1905	..	....	76	48.00
Jan. 27, 1905	76½	47.00	..	....
Feb. 1, 1905	76	48.00	75½	49.00
Mar. 1, 1905	75½	49.00	75	50.00
Apr. 20, 1905	75	50.00	74½	51.00
Oct. 2, 1905	79	42.00	78	44.00
Nov. 1, 1905	79	42.00	..	....
Jan. 1, 1906	79	42.00	78	44.00
Oct. 12, 1906	77	46.00	76	48.00
Dec. 4, 1906	76	48.00	..	....
Dec. 19, 1906	76	....	75	50.00
Dec. 20, 1906	75	50.00	..	....
Jan. 24, 1907	74	52.00	..	....
Jan. 25, 1907	74	....	70	60.00
Feb. 4, 1907	74	52.00	..	....
Mar. 14, 1907	72	56.00	..	....
June 10, 1907	..	....	68	64.00
Oct. 19, 1907	..	....	70	60.00
June 10, 1908	74	52.00	72	56.00
Feb. 19, 1909	79	42.00	78	44.00
Mar. 15, 1909	..	....	78	44.00
Aug. 4, 1909	..	....	76	48.00
Sept. 1, 1909	79	42.00	..	....
Oct. 1, 1909	78	44.00	..	....
Jan. 1, 1910	78	44.00	..	....
Oct. 1, 1910	80	40.00	75	50.00
Oct. 2, 1911	81	38.00	75	50.00
Dec. 1, 1911	82	36.00	..	....
Dec. 15, 1911	82	36.00	..	....
Mar. 1, 1912	..	....	75	50.00
June 1, 1912	81	38.00	..	....
July 1, 1912	81	38.00	..	....
July 24, 1912	80	40.00	..	....
Sept. 2, 1912	..	....	74	52.00
Sept. 10, 1912	79	42.00	..	....
Oct. 1, 1912	..	....	74	52.00
Nov. 1, 1912	..	....	73	54.00
Jan. 1, 1913	80	40.00	..	....
Apr. 12, 1913	79½	41.00	..	....
May 27, 1913	79	42.00	..	....
June 2, 1913	..	....	72	56.00
Aug. 8, 1913	80	40.00	..	....
Oct. 27, 1913	80	40.00	..	....
Feb. 2, 1914	79½	41.00	..	....
Apr. 20, 1914	80	40.00	..	....
Nov. 2, 1914	81	38.00	..	....
Feb. 11, 1915	80	40.00	72	56.00
May 1, 1915	79	42.00	71	58.00
June 1, 1915	..	....	71	58.00
June 17, 1915	..	....	71	58.00
Nov. 1, 1915	78	44.00	70	60.00
Jan. 4, 1916	77	46.00	68	64.00
Jan. 20, 1916	76	48.00	66	68.00
Feb. 15, 1916	75	50.00	65	70.00
Feb. 29, 1916	74	52.00	64	72.00
Mar. 15, 1916	73	54.00	63	74.00
Mar. 29, 1916	72	56.00	62	76.00
Apr. 21, 1916	70	60.00	60	80.00
July 24, 1916	70	60.00	60	80.00
Sept. 7, 1916	69	62.00	59	82.00
Nov. 1, 1916	69	62.00	59	82.00
Nov. 15, 1916	68	64.00	58	84.00
Dec. 1, 1916	66	68.00	..	....
Dec. 4, 1916	..	....	56	88.00
Dec. 30, 1916	64	72.00	54	92.00
Feb. 14, 1917	62	76.00	52	96.00
Mar. 5, 1917	60	80.00	50	100.00
Apr. 2, 1917	55	90.00	44	112.00
May 1, 1917	..	....	38	124.00
July 2, 1917	..	....	33	134.00
Nov. 6, 1917	51	98.00	33	134.00
Dec. 13, 1918	54	92.00	..	....
Jan. 1, 1919	..	....	36	128.00
Mar. 21, 1919	57½	85.00	39½	121.00
Jan. 17, 1920	..	....	34½	131.00
Dec. 15, 1920	..	....	34½	131.00
Mar. 1, 1921	..	....	29½	141.00
Apr. 13, 1921	62½	75.00	35½	129.00
July 7, 1921	64½	71.00	39½	121.00
Sept. 1, 1921	..	....	44½	111.00
Sept. 16, 1921	68½	63.00	..	....
Dec. 15, 1921	71	58.00	..	....
Aug. 16, 1922	..	....	39½	121.00
Aug. 23, 1922	68	64.00	..	....
Sept. 12, 1922	..	....	34	132.00
Oct. 19, 1922	66	68.00	..	....

ent companies, adopted Aug. 23, by the National Tube Co., while as of Aug. 16, wrought iron pipe prices were advanced $10 a ton. A second advance dated Oct. 19, put steel prices up $4 a ton further, while a second increase in iron pipe, which came less than a month after the first one, put prices up $11 a ton more.

Observance of the card discounts was not particularly rigid over the early part of 1922, cutting being especially marked in line pipe. Since production and shipments suffered during the second and third quarters of the year from the coal strike, the mills still were heavily committed on low-priced tonnage when the first advance was made in August, and the mills did not benefit much, if any, by the increase, especially as there came soon afterward the 20 per cent increase in wages. The second advance about made good the increase in wages. Mills were able throughout the year to make fairly prompt shipments of oil well and line pipe, but from the spring until the end of the year they seemed unable to satisfy their customers on standard pipe, particularly on the butt welded sizes.

The outlook for 1923 is for a better balance between orders for standard pipe and oil country goods as it is believed building operations will be lighter in 1923 than in 1922, and the oil industry is expected this year to register some recovery.

COSTS EXCESSIVE

President Campbell Explains Inadequate Profits—Preparing to Take Over Brier Hill Steel Co.

"Because of abnormal production costs, profits in the iron and steel industry have not been adequate this year," states James A. Campbell, president Youngstown Sheet & Tube Co., Youngstown. "This is true, even with a fair volume of business coming to the mills. Our main troubles may be traced to the excessive cost of production, due principally to high prices of fuel and high freight rates. Selling prices of iron and steel products have not advanced in proportion to these costs. Whether they can do so without danger of checking demand is problematical.

"The year 1922 began with little or no improvement, as compared with adverse conditions which prevailed in 1921, and it was not until well along in the summer that real betterment was felt. Since that time, demand has continued to improve and employment has been fairly satisfactory. The wage advance on Sept. 1 helped to improve the situation from the standpoint of employees, but from that of the management, conditions still leave much to be desired."

The Sheet & Tube company is preparing to take over the Brier Hill Steel Co., which it recently acquired. Whether it will be operated as a subsidiary or its identity dissolved and the plants operated as part of the Sheet & Tube company is still undetermined. Sales offices will be consolidated, and the branch offices which the Brier Hill company has maintained will be discontinued.

In financial and industrial circles, reports are current that the Sheet & Tube company is making determined efforts to acquire a manufacturing property in the Chicago district, and has been negotiating for the acquisition of both the Inland Steel Co. and the Steel & Tube Co. of America.

The Youngstown independent also is planning construction of a privately owned railroad from the Mahoning Valley to the Ohio River, and eventually to the lakes. Such a road would prove highly valuable for coal movement to the Youngstown district from the western Pennsylvania fields.

1922 Ends with Good Promise for Early 1923

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manufacturing consumers, after their drastic reduction of inventories in 1921, probably has not been completed. Buying in December has been more than steel manufacturers had looked for, and the freely predicted yielding in prices toward the end of the year has not materialized.

It is not to be expected that either pig iron or steel capacity will be taxed by the demand of 1923, good as the outlook now is. Steel works costs are high and it is not yet clear that producers can come to a satisfactory basis of profit in 1923. The question that came up immediately after the coal strike settlement and the 20 per cent advance in steel works wages, whether a maintained demand on a prosperity scale could be expected, with finished steel at 2 cents for plates, shapes and bars is still a live issue. Leaders in the industry do not overlook the possibility that in the coming year demand may be checked by the forcing up of prices because of rising costs.

There has been much disposition to take for granted a coal strike on April 1. With the hardships of the past year fresh in mind, the public will not be tolerant of another strike and the pressure for a settlement would be prompt and insistent. Agreement between the union miners and the operators is probably more likely than the continuance without interruption of operations in non-union districts. It is not unlikely that the attempt to organize non-union mines will be pushed more determinedly than ever.

Without dwelling on the possibilities of the situation in Europe, concerning which it is to be said that its desperateness is also the promise of its betterment, there is enough in underlying conditions to restrain one's predictions for 1923. The unadjusted factors in labor, transportation and in other directions operate against the attainment of real prosperity. The steel trade saw with satisfaction the expansion of business in 1922 beyond anything it had hoped for when the year began. Remembering the capacity of the industry for rapid changes, it is chary of predicting that the present scale of operations will continue through the next twelve months. So much of the 1922 activity was based on 1.30c., 1.40c. and 1.50c. steel, that it is not surprising that the question is raised whether a like volume of business should be expected in the new year on a 2c. basis for the commoner forms of finished steel.

Basic Business Conditions Improving

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mobile uses has lagged behind the production of pleasure cars and trucks, and has in a measure hampered the car builders in turning out their product. And it is in these basic commodities that the next few months should show the greatest gains.

Unemployment, except in sporadic instances, is a thing of the past. Rather is it now a case of bidding high for such labor as is to be had. Labor is not giving unstintingly of its efforts and much is to be desired along the line of individual production per man. So long as this scarcity of labor exists, and the men feel their power to force wages and other conditions to their liking, just so long will the American people be plundered, and their progress hampered, through this lack of labor efficiency. All in all, however, the prospects for the new year appear unusually bright and, if it is possible to pass the first of April without another disastrous coal strike, the year ought to become one of the most prosperous in the history of the United States.

Pig Iron and Old Material Prices in Leading Centers

Average Monthly Prices of Pig Iron Delivered Philadelphia or Vicinity in 1922

	Basic Delivered East. Pa.		Standard Low Phos., f.o.b. Furnace*		Virginia No. 2X, Delivered Philadelphia*
January	$20.17	January	$30.00	January	$27.84
February	19.84	February	30.00	February	27.61
March	22.61	March	30.00	March	27.24
April	21.00	April	30.00	April	27.74
May	24.00	May	30.00	May	28.24
June	25.00	June	30.00	June	28.24
July	25.75	July	30.00	July	30.17
August	27.22	August	33.00	August	30.17
September	30.83	September	38.00	September	36.17
October	29.30	October	38.00	October	38.17
November	27.82	November	38.00	November	37.17
December	27.31	December	35.00	December	33.93

*Prices were nominal during considerable part of year, there being no Eastern iron available.

Average Monthly Prices for Leading Grades of Scrap, Per Gross Ton, Delivered, Pittsburgh

1922	Heavy Melting Steel	No. 1 Cast Cupola	Bundled Sheets	Machine Shop Turnings	Cast Iron Borings
January	$14.30	$16.30	$10.50	$9.60	$10.90
February	14.00	16.00	10.3125	9.5625	11.0625
March	15.125	15.9375	12.125	10.50	11.9375
April	16.375	16.875	13.25	11.875	13.375
May	17.30	18.50	14.20	13.30	14.10
June	17.00	18.75	13.625	13.3125	14.625
July	17.375	19.00	14.50	14.00	16.00
August	17.75	19.00	15.10	14.00	15.70
September	20.125	22.125	16.375	14.75	17.00
October	21.40	24.00	17.10	16.20	18.60
November	20.50	23.125	17.375	16.625	17.85
December	20.125	22.375	17.375	15.625	17.50

Average Monthly Pig Iron Prices, f.o.b. Valley Furnace, Per Gross Ton, 1922

	Bessemer	Basic	No. 2 Foundry	Gray Forge	Malleable
January	$19.60	$18.15	$19.30	$19.00	$19.50
February	19.50	17.75	18.875	18.8125	19.00
March	19.50	17.9375	19.00	18.75	19.00
April	20.625	20.00	20.75	20.4375	19.50
May	24.40	24.60	23.80	23.30	24.20
June	25.00	25.00	24.00	23.50	24.50
July	25.00	24.25	24.25	23.75	25.125
August	28.20	26.60	32.60	29.45	29.50
September	33.50	32.625	34.875	34.125	33.50
October	33.40	30.90	31.80	31.10	32.70
November	31.75	27.625	27.875	27.625	29.00
December	28.125	24.8125	25.625	25.25	26.25

Foundry and Scrap Prices, Cincinnati, 1922

	Southern Foundry No. 2	Southern Ohio No. 2	No. 1 R.R. Wrought (Net Ton)	No. 1 Machinery Cast (Net Ton)
January	$20.75	$22.15	$9.00	$14.00
February	20.25	22.02	8.63	13.63
March	19.75	21.37	9.05	14.05
April	21.00	22.77	10.50	15.50
May	21.94	25.27	11.25	16.25
June	22.95	25.52	11.65	16.25
July	22.18	26.40	11.75	16.25
August	24.90	30.17	12.05	17.45
September	30.05	34.27	13.75	19.88
October	31.36	34.52	14.75	21.25
November	28.45	31.82	14.35	20.85
December	26.80	29.27	14.25	20.75

Discovery of Copper Ore in Sweden

WASHINGTON, Jan. 2.—Declared to be of "important economic interest to Sweden" the chief of the Swedish Geological Survey has presented to the Government a report regarding the discovery of a vein of copper ore, 13.5 meters thick, possessing a quality not equaled in Scandinavia. Information to this effect has been received by the Department of Commerce through Consul General D. I. Murphy, Stockholm. The vein is in the neighborhood of "Bjurforskältet" in the Norsjö district, province of Västerbotten, a few Swedish miles from a railroad, a Swedish mile being a little more than six English miles. Report is also made of a find described as zinc ore and sulphur pyrites, which is said to "look promising."

The Erie Malleable Iron Co., Erie, Pa., has recently insured their employees, numbering about 1500, under a group insurance policy. Each employee is insured for $1,000.

Transition Year in Railroad Buying

Marked Improvement Over 1921, but Purchases Do Not Equal Average for Thirteen Years Before the War

BY G. L. LACHER

RAILROAD buying broke no records in 1922, but it proved much heavier than for several years and supplied the mills with a substantial backlog of business throughout the entire year. In the early part of the year, when activity in the steel market was at a low ebb and prices were very weak, producers had little to fall back on outside of the tonnage emanating directly or indirectly from the railroads. The transition from a buyers' to a sellers' market did not come until April; yet in the three months of lean business—January, February and March—the railroads placed orders for 35,638 freight cars, or more than 20 per cent of their total purchases for the year. In the first half of the year, their orders for freight equipment totaled 98,000 cars, or more than half of the number bought for the entire 12 months.

Locomotive buying was extremely light in the first half, accounting for only 20 per cent of the total number of orders for the year. From the standpoint of the mills, however, purchases of cars, particularly freight cars, are of much more importance in terms of rolled steel tonnage than locomotive orders. Rail buying for 1922 delivery was also concentrated in the first half of the year. Ordinarily heavy rail orders are placed in the fall and winter preceding the year in which rolling is desired, but on Jan. 1, 1922, hardly 400,000 tons were on the books of the mills. Additional orders for 1922 delivery, amounting to approximately 500,000 tons, came in largely in the first four months of the year and with the exception of an insignificant tonnage were entirely booked by July 1. Rail purchases for 1923 delivery were heavy and were largely made just prior to the advance of standard sections effective Oct. 1. Buying of track supplies has been liberal throughout the year and car repairs have put considerable tonnage on mill books. Bridge and building work has been on a broader scale than in 1921 and machine tool purchases were likewise more liberal.

Freight Car Orders

Orders for freight cars placed with American car companies during the year just closed aggregated 173,732 freight cars, 96,974 cars for heavy repairs and 1669 passenger, mail, baggage and dining cars. There were also 1133 cars bought for export. This greatly exceeds the annual average of purchases during the eight years, 1914 to 1921, inclusive, which is 85,400 cars. It falls short of the average of 180,400 cars for the 13 years, 1901 to 1913 inclusive, and is slightly over 50 per cent of the total for the record year, 1905, which was 341,315. It is to be noted, however, that freight cars today are larger and heavier than they were then and require proportionately more steel. The cars ordered this year involve fully 2,000,000 tons of rolled steel alone, not counting castings. A large part of the cars ordered during the year were placed by Western roads, a fact which accounts for the heavy bookings of Chicago district car builders and the large commitments of car steel taken by Chicago mills.

Extensive Repair Work

Car repair work was done on a broad scale during the year both in the railroad shops and in private plants. With the calling of the shopmen's strike, the carriers found it impossible to continue the programs undertaken in their own yards and shops and placed large contracts with car builders. It is interesting that at the same time that orders for new cars dropped off, the letting of repair work increased. Fully two-thirds of the cars placed for repairs with private shops during the year were let during the four months, June, July, August and September inclusive. The table shows the orders by months for new freight cars and heavy repairs.

Whereas Western roads bought more new freight equipment than Eastern lines, the situation was reversed on lettings of repairs. Most of the cars placed for repairs with private shops were let by carriers serving the territory east of Chicago.

Orders Placed with American Car Builders in 1922

Month	New Freight Cars	Freight Cars for Repairs
January	8,382	1,664
February	14,322	8,784
March	12,934	2,271
April	25,646	6,862
May	22,727	5,862
June	14,066	15,316
July	12,868	22,693
August	2,844	16,562
September	13,388	11,621
October	8,324	3,766
November	13,781	1,575
December	24,450*	†
Totals	173,732	96,974

*Estimated. †None reported.

Passenger Cars and Locomotives

Passenger car orders for the year total 2014, the largest number bought since 1916 when 2544 were contracted for. The figure is considerably larger than the average of orders for the eight years, 1914 to 1921 inclusive, which is 1400, but fails to equal the average of 2961 cars for the 13 years, 1901 to 1913 inclusive. With reference to the geographical distribution of the year's orders, the situation is the reverse of that obtaining in freight cars. Nearly 57 per cent of the total was placed by Eastern roads. The amount of steel involved, however, was insignificant compared with that required for the freight equipment.

Locomotive orders for 1922 aggregated 2376, as compared with an average of 1692 for the period of light buying, 1914 to 1921 inclusive, and an average of 3800 for the 13 years, 1901 to 1913 inclusive. The total for the year is the best since 1918 when 2593 locomotives were purchased, but falls far short of the record of 6265 in 1905. The steel requirements of a locomotive are considerably heavier per unit than those of either passenger or freight cars. The average engine takes from 40 to 50 tons in steel plates alone; so that the plates involved in this year's purchases aggregate fully 105,000 tons. This figure, it should be noted, does not include a considerable tonnage in other forms of rolled steel, tubing, forgings and castings.

Orders for Rails

Nineteen-twenty-two has been an excellent rail year. Orders placed during the year for 1922 rolling amounted to nearly 500,000 tons, while contracts closed

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for 1923 delivery account for about 2,000,000 tons more, of which 750,000 tons will be furnished by Chicago mills. Reference to past records shows that the consumption by American roads during the eight years, 1914 to 1921, inclusive, averaged 2,007,970 tons, and during the 13 years, 1901 to 1913 inclusive, 2,815,558 tons. The record year was 1906 with 3,654,794 tons.

Machine Tools

Railroad purchases of machine tools were much heavier than in 1921, but by no means proportionate to orders for rails and rolling stock. Very little buying was done during the first half of the year, but during the last six months a number of large lists were finally bought after long drawn-out negotiations. In round figures the expenditures of a number of roads were as follows: Illinois Central, $600,000; Chicago, Burlington & Quincy, $600,000; Santa Fe Lines, $400,000; Union Pacific, $200,000; Rock Island Lines, $100,000; Delaware, Lackawanna & Western, $100,000; St. Louis-San Francisco, $40,000; Seaboard Air Line, $30,000. The Missouri, Kansas & Texas purchased a list of 116 items, while the Pennsylvania Lines East closed for 80 tools for its Altoona, Pa., shops. The New York Central Lines bought considerable equipment in purchases of a few machines at a time scattered over the entire year.

The carriers also placed a number of large crane orders. Among them may be mentioned cranes involving $225,000 bought by the Pennsylvania Lines East for its Altoona shops. The Chicago, Burlington & Quincy was also a liberal purchaser. For its new Denver, Col., shop it ordered one 50-ton, one 10-ton, two 125-ton, two 25-ton and three 15-ton overhead electric traveling cranes and for its Eola, Ill., scrap yard two 15-ton gantry cranes. The Missouri, Kansas & Texas spent $60,000 for cranes. Among orders for individual machines which stand out may be mentioned a 250-ton gap crane bought by the Erie for its Hornell, N. Y., shops and a 150-ton crane purchased by the Santa Fe for its Albuquerque, N. M., shops.

Shop Equipment

Locomotive builders figured as buyers of shop equipment during the year. The Lima Locomotive Co. closed for $200,000 worth of machine tools, while the Baldwin Locomotive Works bought a list of 40 tools in addition to a number of single machine orders placed at various times throughout the year. The American Locomotive Co. purchased eight tools for its Richmond, Va., plant and as the year closes is expected to issue an extensive list for its Schenectady, N. Y., works.

Prospects for shop equipment buying by the railroads in 1923 appear favorable. The Missouri Pacific has a list of 53 items pending, while the Delaware, Lackawanna & Western is receiving figures on 27 tools. The Chicago, Burlington & Quincy is completing its 1923 budget with the likelihood that a large inquiry will be put out in a month or two.

Marked Improvement

Reviewing railroad buying as a whole, it is apparent that 1922 was a transition year, showing marked improvement over 1921, but nevertheless failing by a considerable margin to equal record years. After the eight lean years, 1914 to 1921 inclusive, substantial progress has been made toward the rate of buying which obtained during the 13 good years, 1901 to 1913 inclusive, and it is the confident belief of many observers that this progress will continue. While purchases cannot be forecast on the basis of the unsatisfied needs which have accumulated during the long period of light buying, the carriers appear to be in a much better position to satisfy those needs than a year ago.

Reading Iron Co. Appointments

The Reading Iron Co., Reading, Pa., which, as announced in the Dec. 28 issue of THE IRON AGE (p. 1701) has taken over the blast furnace and ore properties of the Thomas Iron Co., has made the following appointments, effective Jan. 1:

Harry F. Mattern to be sales manager of the Reading Iron Co., succeeding the late E. J. Mishler.

J. Norman Sherer to be general superintendent of ore mines and blast furnaces of the Reading Iron Co. and the Thomas Iron Co.

Paul O. Wolf to be superintendent of the Keystone furnace of the Reading Iron Co.

C. Bickel to become assistant superintendent of the Keystone furnace of the Reading Iron Co.

Howard A. Knauss to be superintendent of the Hokendauqua furnace of the Thomas Iron Co.

H. L. Knauss to become superintendent of the Crumwold furnace of the Reading Iron Co.

The large Hokendauqua furnace of the Thomas Iron Co., with capacity of about 400 tons daily, will be put in blast Jan. 15, instead of Jan. 1, as announced last week.

W. A. Barrows, Jr., who has been president of the Thomas Iron Co. for many years, will continue in that capacity. L. E. Thomas, president of the Reading Iron Co., has been elected vice-president and director of the Thomas company.

Mr. Mattern, who has been appointed sales manager of the Reading Iron Co., has been assistant sales manager for about 12 years. He succeeds E. J. Mishler, who died on Dec. 11. Mr. Sherer has been superintendent of the Keystone furnace of the Reading Iron Co. since Dec. 1, 1915. Mr. Wolf, who was chief chemist of the Keystone furnace, has been with the company since 1906. Mr. Bickel, who was general foreman at the Keystone furnace, has been connected with the company since it was organized in 1889. Howard A. Knauss was formerly superintendent of the Crumwold furnace, having occupied that position since 1910. H. L. Knauss, son of Howard A. Knauss, has been assistant superintendent at the Crumwold furnace of the Reading Iron Co. since 1911.

Decreased Demand for Freight Cars

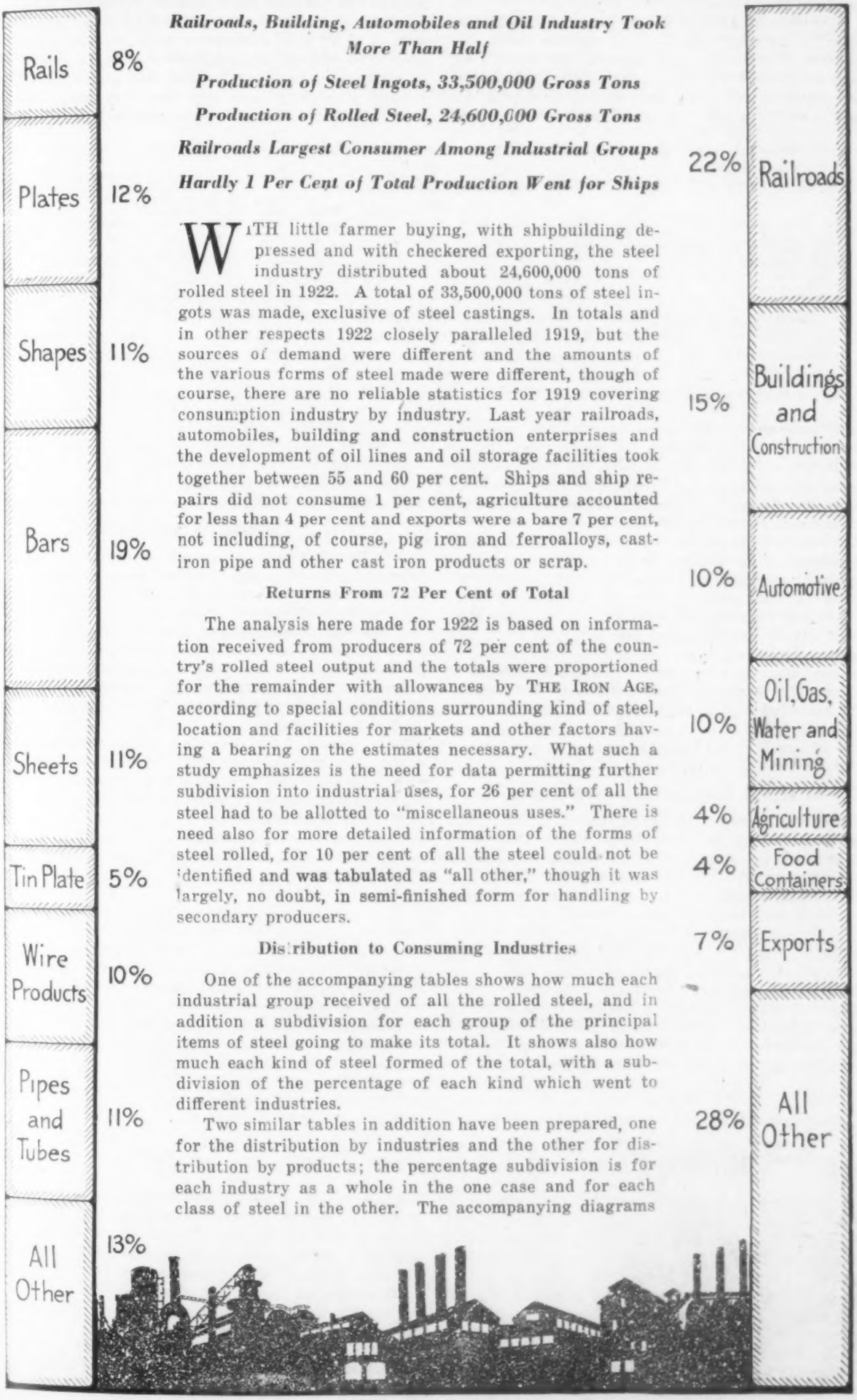
WASHINGTON, Jan. 2.—A further decrease in the demand for freight cars in excess of the current supply is shown by reports received from the rail carriers by the Car Service Division of the American Railway Association. The total shortage in cars on Dec. 15 amounted to 105,018, compared with 111,961 on Dec. 8, or a decrease of 6943 cars. The shortage in box cars was 49,495, a decrease within a week of 7216. The shortage in coal cars totaled 41,200 which was, however, an increase within the same period of 3587 cars.

Reports so far received for December show that the loading of revenue freight is the heaviest on record for this time of the year. Cars loaded with revenue freight during the week which ended on Dec. 16 totaled 888,082. This was an increase of 162,008 cars or 22 per cent over the total for the corresponding week last year, and an increase of 85,811 cars or 10.7 per cent over the corresponding week in 1920.

Due to the usual seasonal decline in loading, the total for Dec. 16 was a decrease of 31,756 cars or 3.4 per cent under the week before. Movement of agricultural products is the greatest for this time of the year in history, exceeding by a considerable margin that for the corresponding periods, both in 1921 and in 1920.

Coke loading totaled 13,226 cars, an increase of 175 cars over the week before. This also was an increase of 6061 cars above the corresponding week last year, and an increase of 886 cars above the corresponding week in 1920.

Where Steel Went in Nineteen Twenty-Two



Railroads, Building, Automobiles and Oil Industry Took More Than Half

Production of Steel Ingots, 33,500,000 Gross Tons

Production of Rolled Steel, 24,600,000 Gross Tons

Railroads Largest Consumer Among Industrial Groups

Hardly 1 Per Cent of Total Production Went for Ships

WITH little farmer buying, with shipbuilding depressed and with checkered exporting, the steel industry distributed about 24,600,000 tons of rolled steel in 1922. A total of 33,500,000 tons of steel ingots was made, exclusive of steel castings. In totals and in other respects 1922 closely paralleled 1919, but the sources of demand were different and the amounts of the various forms of steel made were different, though of course, there are no reliable statistics for 1919 covering consumption industry by industry. Last year railroads, automobiles, building and construction enterprises and the development of oil lines and oil storage facilities took together between 55 and 60 per cent. Ships and ship repairs did not consume 1 per cent, agriculture accounted for less than 4 per cent and exports were a bare 7 per cent, not including, of course, pig iron and ferroalloys, cast-iron pipe and other cast iron products or scrap.

Returns From 72 Per Cent of Total

The analysis here made for 1922 is based on information received from producers of 72 per cent of the country's rolled steel output and the totals were proportioned for the remainder with allowances by THE IRON AGE, according to special conditions surrounding kind of steel, location and facilities for markets and other factors having a bearing on the estimates necessary. What such a study emphasizes is the need for data permitting further subdivision into industrial uses, for 26 per cent of all the steel had to be allotted to "miscellaneous uses." There is need also for more detailed information of the forms of steel rolled, for 10 per cent of all the steel could not be identified and was tabulated as "all other," though it was largely, no doubt, in semi-finished form for handling by secondary producers.

Distribution to Consuming Industries

One of the accompanying tables shows how much each industrial group received of all the rolled steel, and in addition a subdivision for each group of the principal items of steel going to make its total. It shows also how much each kind of steel formed of the total, with a subdivision of the percentage of each kind which went to different industries.

Two similar tables in addition have been prepared, one for the distribution by industries and the other for distribution by products; the percentage subdivision is for each industry as a whole in the one case and for each class of steel in the other. The accompanying diagrams

are offered as supplementary to the tables, of which they give the picture.

The diversification of even a year like 1922 is indicated by the compilation. Of 90 separate items, only 12 were of relatively large amount, such as rails for domestic consumption; plates for cars and locomotives and plates for oil tanks, plain structural material for cars (which includes tie plates and other railroad track accessories) and shapes for buildings, steel bars for the automotive industry, for the railroads and for buildings, sheets for automobiles, tin plate for food containers, and pipe for buildings and for oil country demands. These twelve items amounted in all to about 47 per cent of total production, leaving an average of two-thirds of one per cent for each of the remaining 78 groupings, many of these in the rather large "miscellaneous" or "all other" items, to which reference already has been made.

Consumption by Various Industries in 1922 of Different Forms of Finished Steel, Expressed in Percentage of Total Rolled Steel Production

	Rails	Plates	Shapes	Bars	Sheets	Tin Plate	Wire Prod'ts	Pipe and Tubes	Hoops, Bands, Etc.	Forging Billets, Etc.	All Other	Total
Automotive	...	½	...	4¼	3½	...	½	...	¾	...	½	10
Railroads	6	4½	3½	3¾	1	...	¼	¼	...	¼	2½	22
Agriculture	...	¼	¼	1¼	¼	...	1¾	...	...	...	¼	4
Buildings and other construction	...	1¾	4½	3	½	...	...	3¼	½	...	1½	15
Shipbuilding	...	½	¼	¼	...	...	...	...	...	...	...	1
Food containers	...	...	...	...	...	3½	...	...	½	...	...	4
Other tin plate uses	...	...	...	...	...	1	...	...	...	...	...	1
Oil, water, gas and mining	...	3	½	½	½	...	¼	4½	¼	¼	¼	10
Exports	1	½	½	½	1½	½	1	½	...	...	1	7
Miscellaneous	1	1	1½	5½	3¾	...	6¼	2½	½	1	3	26
	8	12	11	19	11	5	10	11	2½	1½	9	100

Among the classes of steel for which a more complete list of their industrial uses is needed are sheets, wire products and pipe and tubes. Strip steel is a product whose uses have been increasing remarkably in the past few years, as is told further on. But the basis for an estimate of its total production is meager. One estimate for 1922 went as high as 750,000 tons, but few producers would hazard a guess as to how much of this went on the market as cold rolled strip.

Lighter Products Show Great Growth

In recent years the lighter forms of steel—wire products, sheets, tin plate, hoops, bands, strip—have been piling up tonnage in an astonishing way. Rails, shapes, plates and bars no longer constitute the bulk of the country's output, and at that the section of rails used has been made heavier and heavier.

From the statistical records we have made the diagram on page 101, showing that the combined tonnage of wire products, sheets (including black plates for tinning), and hoops, bands and cotton ties (no statistics of other forms being available) has increased from 21.6 per cent of the total in 1905 and 1906 to 27.7 per cent for 1914, 1915 and 1916 and was 26.8 per cent for the years 1919, 1920 and 1921.

Distribution Through Jobbers

Naturally no approach to accuracy can be made in assigning destinations to the steel products handled by jobbers. In war time, when Andrew Wheeler of Philadelphia was at Washington at the head of the jobbing division of the steel distribution work, an inquiry was made from which it was concluded that on the average 10 per cent of the country's rolled steel product is distributed through jobbers, and there have been estimates which put the amount between 10 and 15 per cent. Of the merchant pipe output it is well known that 75 per cent is handled by jobbers. Of bars, wire nails, sheets and tin plates jobbers handle an important tonnage, relatively less of plates and shapes and a negligible tonnage in standard section rails.

"Normal" Consumption in Various Lines

Of the thousands of questions the mails have brought to THE IRON AGE in recent years, probably no class is larger than those relating to the percentage of the country's steel output going annually into this or that channel of consumption. Generally the questioner has asked what proportion of the total "normally" goes to the railroads, to agriculture, to automobiles, to building and so on. The impression is common that there is a "normal" consumption in this or that line.

The fact is that not only the *amounts* of steel but the *percentages* of the total which go into specific uses change from year to year. With the constant development of new uses for steel, the percentage representing old uses grows less, and also the quantitative variations in the old uses themselves are by no means inconsiderable. The railroads took approximately 22 per cent of the finished steel produced in 1922, but probably not 12 per cent of the very much smaller steel total produced in 1921.

The automotive industry produced twice as many cars last year as in 1921 and used somewhat less steel per car. The production of finished steel was about 24,600,000 tons in 1922, or 73 per cent more than the 14,200,000 tons of 1921. The automobile makers carried over large stocks of steel from 1920 to 1921. They carried over little into 1922 and in that year did quite an amount of restocking. The automotive industry took 10 per cent of the steel products shipped in 1922 and less than 5 per cent in 1921. Under all the conditions just stated who shall say whether 10 per cent or 5 per cent is nearer normal?

Railroad Car and Locomotive Purchases in 1922

ALTHOUGH the railroads and industrial companies of the United States ordered upward of 170,000 freight cars and 2014 passenger cars during 1922, the actual number of freight cars delivered was approximately 64,232. The number of locomotives ordered up to Dec. 23 was 2284, for both railroad and industrial use, and the number actually built and delivered was probably about 1500.

An important item in railroad work during 1922 was repair work. In the 11 months ended Nov. 30 there had been rebuilt in the shops of car building companies 57,486 cars, and an estimate for December is 5000 additional, bringing the total for the year up to 62,486. This work is exclusive of the minor repairs, which usually are done in the railroad companies' own shops.

In estimating the amount of steel used for freight car construction the approximate tonnage of plates, shapes, bars and axles in cars of various types has been taken and no allowance made for steel castings and the car accessories made by railroad specialty manufac-

turers. The figures for the first 11 months of 1922 are as follows:

Type of Car	Number Built	Average Tons of Steel Per Car	Total Steel Used
Box	16,319	9	146,871
Flat	534	10	5,340
Stock	538	10	5,380
Gondola	11,123	14	165,722
Hopper	14,675	17	249,475
Tank	611	15	9,165
Refrigerator	8,699	10	86,990
Caboose	11	9	99
All others	1,722	15	25,830
*Cars built in December	10,000†	12	120,000
Total	64,232		814,872

*Estimated. †All types.

Passenger cars actually built and delivered during 1922 numbered only 701. As each passenger car takes about 14 tons of steel the total used for this purpose would be only about 10,000 tons. Locomotive companies figure an average of about 100 tons of steel for each locomotive, some of the heavier types running well above this figure, so that 1500 locomotives built during the year would give a total steel consumption of 150,000 tons, including plates, shapes, bars, axles, etc.

The cars let for heavy repairs by the railroad companies probably took an average of five tons of steel per car, which would make a total of about 300,000 tons for that purpose. In addition the railroads of the country probably took two or three hundred thousand tons of steel for repairs done in their own shops.

Thus it may be figured that new cars, repairs both by car building companies and by the railroads in their own shops, and new locomotives took a total of close to 1,500,000 tons of rolled steel. In addition the steel companies shipped over 1,500,000 tons of rails during the year.

This total of 3,000,000 tons does not account for large quantities of other steel products which the railroads have bought, such as track accessories, sheets, wire products, pipe, boiler tubes.

As orders for new cars and locomotives were fairly heavy in the last four months of the year, involving in the case of cars nearly 60,000, it is quite possible that car building companies received in 1922 fairly large tonnages of steel from the mills, which will not be reflected in finished cars until the first two months of the new year have gone.

Large Demand of Building Work for Shapes and Bars

FIGURES compiled by the Bridge Builders and Structural Society during the first three months of 1922 and those kept since that time by the Bureau of the Census, Department of Commerce, show that a total of 1,460,241 tons of structural steel had been fabricated in the first 11 months of the year in the shops of the United States. Adding 100,000 tons for December, which is probably an outside figure, the total for the year would be 1,560,241 tons.

An interesting sidelight on these figures is the compilation made by an Eastern fabricating company on the tonnage fabricated for erection in the metropolitan district consisting of New York, the eastern section of Long Island and northeastern New Jersey. The total for this district, exclusive of general construction work such as subways, elevated, etc., is 375,000 tons. Allow- for this district, exclusive of general construction work aside from buildings it is evident that the New York metropolitan district took fully one-third of the fabricated steel for the year.

A Record-Breaking Building Year

Of important bearing on the distribution of steel products during 1922 is the fact that the past year was the largest in volume of new construction the country has ever known. Figures compiled by the F. W. Dodge Co., New York, in 37 States show that approximately $3,300,000,000 was spent in the 12 months in those States for all types of building construction, and estimating the amounts expended in the other 12 the company arrives at a total figure of $4,300,000,000, as compared with $3,142,000,000 in 1921.

More than 100,000 new buildings of all types were contracted for last year. The largest single item was residential buildings, including everything from apartment houses to small individual dwellings, and of such buildings there were close to 70,000, having a total value of about $1,220,000,000 in the 37 States from which the Dodge company received reports. Public utilities came second with nearly 10,000 buildings costing about $540,000,000. Business buildings were third with close to 12,000 projects and involving an expenditure of nearly $500,000,000.

Prospects for 1923 Considered Good

The F. W. Dodge Co. estimates that 1923 building construction will come about half way between that of 1921 and 1922; in other words, about $3,750,000,000.

"At the present moment it does not seem likely that the 1922 record will be repeated in 1923," said Thomas S. Holden, statistician for the F. W. Dodge Co. "Although there is still an enormous demand for residential construction, and although many localities which have not yet had any substantial building revival will probably do better in 1923, it would appear that residential construction will not be so large in volume in 1923 as it has been in 1922.

"While mercantile and industrial construction will probably increase, it seems doubtful that they will be in sufficient volume to offset the probable decline of residential construction. The building revival seems destined to extend well into 1923. But it appears that the 1923 program will be different from that of 1922 in character and somewhat less in total volume, although the volume will be well up to what may be termed normal."

Percentage of Total Production of Rolled Steel Going into Wire and Wire Products, Sheets of All Kinds, Hoops, Bands, Etc., Indicating an Increasing Importance of the Lighter Forms of Steel. The shaded portions represent the total of all other forms, including rails, shapes, plates, bars, etc. In each case the production figures of three years were taken, those for the year named and the year before and after

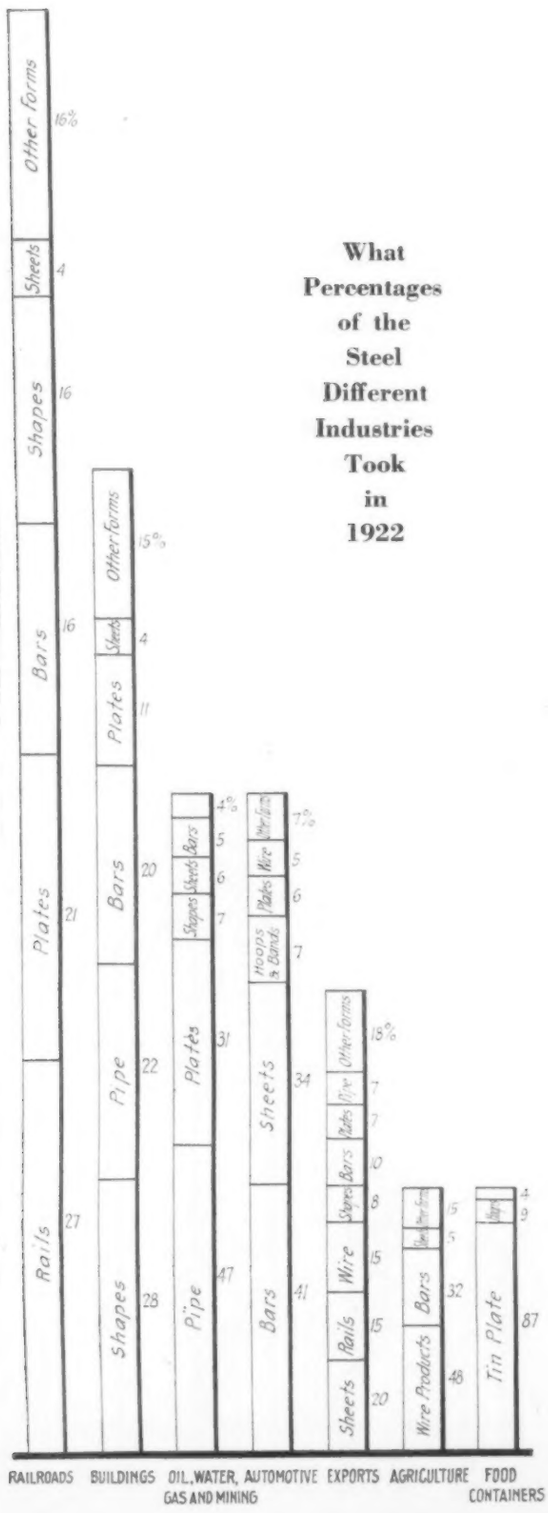
The quantities of steel products other than structural shapes which enter into building construction have, of course, been a considerable item during 1922, but accurate estimates of these amounts have been difficult to compute. Mills rolling wire, nails, pipe for heating, ventilating, electric wire conduits, etc., have felt the effects of large building construction in their order books, and indications point to a similar volume of business in these lines throughout at least the first half of 1923.

600,000 Tons of Concrete Reinforcing Bars

Leading interests in the concrete reinforcing bar trade estimate that 1922 consumption of steel bars for

Percentage of Different Forms of Steel Making Up the Total Consumption in 1922 of Each of a Number of Industries

	Rails	Plates	Shapes	Bars	Sheets	Tin Plate	Wire Products	Pipe and Tubes	Hoops and Bands	Forging Billets	All Other
Automotive	..	6	1	41	34	..	5	1	7	..	4
Railroads, inc. cars and locomotives	27	21	16	16	4	..	1	1	..	1	12
Agriculture	..	3	2	32	5	..	48	..	1	2	7
Buildings and other construction	..	11	28	20	4	..	3	22	2	2	9
Shipbuilding	..	45	19	23	5	..	1	..	..	7	..
Food containers	..	..	..	1	..	87	3	..	9	..	..
Oil, gas, water and mining	..	31	7	5	6	1	1	47	1	1	..
Exports	15	7	8	10	20	4	15	7	1	..	13
Miscellaneous	3	4	5	20	15	..	21	11	3	3	15



building purposes was approximately 600,000 tons. This estimate is based on the statistics of the American Iron and Steel Institute for previous years, taking into consideration the remarkable construction activity of the past year. In 1920 the consumption of concrete bars was 571,747 tons, and it is estimated that 1922 consumption exceeded this figure. With the exception of 1918 and 1921 the consumption of concrete bars each year since 1915 has well exceeded 400,000 tons. There are more than 50 plants in the United States rolling concrete bars.

Great Growth of the Strip Steel Industry

BECAUSE of the growing uses of both hot and cold rolled strip steel, THE IRON AGE has conducted a special investigation to determine as closely as possible (1) the approximate production in 1922; (2) the more important uses to which it is being put, and (3) the newer uses for strip steel.

The American Iron and Steel Institute estimated the production of hot rolled strip steel for 1920 as 500,000 gross tons and for 1921, 204,000 gross tons. Some estimates of 1922 production are as high as 750,000 tons and others range from this figure down to 600,000 tons, it being generally agreed that 1922 production exceeded that of 1920, which was considered a good year.

The rated capacity of the cold rolled strip mills of the country is about 375,000 gross tons. It is estimated that the industry has operated during the past year at approximately 60 per cent of capacity, which would indicate a total production of 225,000 tons. This is believed to be a fairly accurate estimate of the 1922 production, though some manufacturers rate it as much higher, using figures up to 500,000 tons, which probably is excessive. The figures include the output of the American Steel & Wire Co., whose product is classified as flat wire, though it does not differ materially from that sold by competing manufacturers as cold rolled strips.

Uses Are Growing

Though the uses for both hot and cold rolled strip steel have grown amazingly within the past few years, it appears that there is ample capacity to take care of the country's needs for the next few years at least. One important company has a large equipment, built for war-time requirements, which has not been put to use, as the installation was not completed when the war ended and conditions since have not seemed to justify its operation.

Notwithstanding the apparent excess of capacity, some companies are putting in new equipment, among these being the Pittsburgh Cold Rolled Steel Co., Verona, Pa.; the Elliott-Blair Co., New Castle, Pa.; the West Leechburg Steel Co., Pittsburgh; the Otis Steel Co., Cleveland, and the Acme Steel Goods Co., Chicago.

Distribution by Industries of Consumption in 1922 of Different Forms of Steel

	Automotive	Railroads	Agriculture	Buildings and Const'n	Shipbuilding	Food Containers	Other Tin Plate Uses	Oil, Gas, Water and Mining	Exports	Miscellaneous
Rails	..	77	..	..	..	..	..	..	14	9
Plates	5	37	1	14	4	..	..	25	4	10
Shapes	1	32	1	40	2	..	..	6	5	13
Bars	23	19	6	16	1	..	..	2	4	29
Sheets	32	8	2	6	..	..	..	5	13	34
Tin plate	..	..	..	..	..	70	22	2	7	..
Wire products	5	3	18	5	..	1	..	1	10	57
Pipes and tubes	1	1	..	29	..	..	..	40	4	25
Hoops, bands, cotton ties	29	3	2	14	..	14	..	5	3	29
Forging billets and blooms	5	19	5	5	5	..	..	5	..	57
All other	4	27	3	14	..	..	..	..	10	43

Very few estimates were received as to the distribution of hot and cold rolled strip steel among various consuming industries. It is apparent that this depends greatly upon the location of the plant. Some of the companies in Ohio doubtless sell fully 50 per cent of their output of cold rolled strips to the automobile industry. In New England, where a number of cold rolling mills are located, it is estimated that 30 per cent or more of the output is used for building hardware. One manufacturer in this latter line makes its own strip steel and almost all of its own product goes into hardware. In the past few years pressed metal products made from strip steel have been taking the place of small castings in many directions. Strip steel castors are an example.

Steel Lumber

Steel joists are taking an increasing quantity of hot rolled strip steel. It is reliably estimated that fully 75,000 net tons of hot rolled strips went into steel lumber during 1922, one plant alone, which fabricates steel lumber joists, using about 30,000 tons. Another use for the hot rolled product is the manufacture of Z-shaped sections for street curbing, one company in this line using about 72,000 tons in 1922.

The automobile industry, as is well known, is an important outlet for both hot and cold rolled strips. Perhaps a third to one-half of the output of some plants in one way or another goes into the automotive industry. That this use is growing is indicated by the fact that there has been recently a pronounced movement on the part of some automobile manufacturers to substitute cold rolled strip steel for cold rolled sheet steel in the fabrication of fenders.

Among the uses to which cold rolled strip steel is put, stampings are of considerable importance. Also, in spite of the slow movement of agricultural implements, a surprisingly large tonnage of cold rolled strips went to that use last year. The large number of kerosene lamps still used in various sections of the country which have no electricity or gas lighting furnishes another demand of considerable size. Coffins take large quantities. Many manufacturers of enameled ware use strip steel as a base material. Cutlery is also an outlet that has never been fully emphasized. The most important sources of demand are in the manufacture of automobiles, builders' hardware, office requirements, such as typewriters, adding machines, calculating machines, mimeographs, office files, cabinets, etc. Bicycles and motorcycles must not be overlooked. The multitude of small novelties produced by the process of stamping require in the aggregate an amount difficult to estimate, but it is no small factor. Tubing for metal beds and other purposes forms an imposing share of the total.

A large manufacturer of both hot and cold rolled strips estimates that the automobile industry consumes fully half of the output in one way or another.

There is a considerable range in the sizes manufactured by various companies. The widest strips are

about 24 in., but the capacity of most of the mills does not exceed 16 in. Some of the smaller producers confine themselves to light gage material. Some manufacturers make a distinction between cold rolled strip steel and cold rolled flat wire by assuming that anything 1 in. and wider is strip steel and narrower than 1 in. is classified as flat wire. Box strapping is also sometimes classified as flat wire. The distinction thus drawn is not general, however, and for ordinary trade usage flat wire may be classified as strip steel.

Automobile Industry Takes 2,500,000 Tons of Steel

AN estimate of the quantity of steel used by the automobile industry during 1922, based on the most reliable figures obtainable, leads to the conclusion that 10 to 10½ per cent of the total output of finished steel in 1922 went into automobiles, or about 2,500,000 tons. The high ratio was due to the fact that 1922 was a year of record-breaking production of automobiles and one of moderate output of finished steel. Based on a production of 30,000,000 tons of finished steel and a corresponding production of automobiles the percentage used by the automobile industry would be closer to 8¼ per cent of the total.

Figures compiled by the United States Department of Commerce, in co-operation with the National Automobile Chamber of Commerce, show that up to Nov. 30, 1922, there had been produced in the United States a total of 2,349,974 passenger cars and trucks, and as the estimate of the December production is 176,550 for both cars and trucks, this makes a total for the year of 2,526,524. In arriving at an estimate of the amount of steel consumed for the production of these cars ¾ ton was allowed for Ford automobiles, which are 40 per cent of the entire production; one ton each was allowed for 35 per cent of the remainder, and two tons each for the other 25 per cent. The 25 per cent includes many heavy trucks, which in numbers constitute about 10 per cent of the total motor vehicle production. Some of these trucks take more than 2 tons each. Based on the estimates compiled from automobile trade sources the total indicated consumption of steel by this industry in 1922 was approximately 2,800,000 tons, or higher than obtained from the steel producers.

Figures compiled by the steel companies having a general line of steel products show that in several instances their shipments to automobile companies ranged from 8 to 10 per cent of the total. In the case of certain companies making sheets, hot and cold rolled strip steel and cold finished steel bars and screw stock the percentage of their shipments to the automobile trade run from 25 to 50 per cent of their total production.

Oil Companies Take Over 1,000,000 Tons of Pipe

THE American Petroleum Institute has attempted to calculate the amount of steel and other materials used annually by the oil companies, but without success. The only statistics regularly kept are those of the Interstate Commerce Commission on the construction of interstate oil pipe lines. The latest report of the commission shows that about 4740 miles of interstate pipe line were laid in 1922. At the end of 1921 there was a total of 55,260 miles of interstate pipe lines, and at the end of 1922 this had grown to approximately 60,000 miles. Most of this pipe is of steel and 8-in. in diameter. Figuring 67 net tons to the mile the total for 4740 miles is 318,000 tons.

In addition to the main trunk lines, which carry the oil from the producing fields to terminals located on the Atlantic and Gulf coasts and at the large distributing centers inland, there are thousands of miles of smaller so-called gathering lines. It is through these lines, which are 2 to 6 in. in diameter, that the oil is collected from the wells and gathered in great storage tanks for shipment to distant points.

It is probable that the smaller, gathering lines required several hundred thousand tons of steel in addition to that used in the main trunk lines, so that 1,000,000 tons of steel would probably stand as a conservative estimate of the amount of steel used for oil lines during 1922.

In addition, the oil companies have been large buyers of oil storage tanks, which are fabricated principally from plates. A large fabricator of oil tanks estimates that 400,000 tons of steel, largely plates, was used for this purpose during 1922. This, with the amount of pipe estimated to have been used by the oil companies, places them in the forefront of steel consumers, taking nearly as large a tonnage as does the automobile industry.

Increasing Uses for Tin Plate

IT is estimated by leading factors in the tin plate producing and consuming trade that about 42,000,000 to 44,000,000 base boxes represents fairly accurately the annual capacity of American mills. The 1922 output of both tin and terne plates was probably about 33,000,000 base boxes. Of the tin plate 70 per cent appears to have gone for food containers. There are increasing numbers of products besides food products being put up in tin containers, such for example as tobacco and confectionery. The lithographed can for cigars, cigarettes, candy, etc., has grown in popularity and a considerable tonnage of tin plate is used for such purposes, although the aggregate, of course, is comparatively small.

The amount used for canned foods is regulated by the volume of crop production and the condition of the canned foods market. In 1921 the canners and wholesalers carried over considerable quantities of the 1920 pack and therefore the use of tin plate for the 1921 crop was comparatively small. By the time the 1922 crop harvesting season had arrived, however, the carry-over stocks of canned goods had melted away and there were large demands for fresh goods. This condition, plus the large 1922 crops of fruits and vegetables, created a fairly large demand for tin plate in 1922. It is probable that uses of tin plate will assume larger proportions through the packing of products which hitherto have not been sold in cans, for example as fruit salad, pumpkin flour and similar new specialties in foods.

One large canning company consumes about 7,000,000 base boxes annually and the Pacific Coast canning trade is becoming a more important factor, and it is estimated that fully 3,500,000 base boxes of tin plate were used by the packing companies of that section of the country during the past year.

Implement Industry's Consumption Small

Estimated annual consumption of rolled steel of all kinds by the agricultural implement manufacturing in-

dustry was 1,200,000 tons when a census was taken on behalf of the War Industries Board during the war. It is the opinion of leading manufacturers in the industry that the 1922 consumption was about 40 per cent of this total, or 480,000 tons, which is 1.9 per cent of the estimated finished steel production for 1922. With the exception of 1921, when the implement industry's purchases were considered to be almost nothing because of large stocks of steel and finished machinery carried over from 1920, 1922 is the lowest in steel consumption this industry has experienced. Agriculture took round lots of wire last year but for all forms of steel, shipments to the farmer were less than 4 per cent of the total production of rolled steel.

Seamless Steel Tubing

The most reliable information obtainable on the production of seamless steel tubing in 1922 shows that approximately 200,000 net tons were produced, the country's potential capacity being 320,000 tons. The 1918 output was 292,000 tons; that of 1919, 197,000 tons; 1920, 292,000; 1921, 118,000 tons.

Probably 60 per cent of the total output of seamless tubing in the past year was used for boilers and 40 per cent for mechanical uses. Of the boiler tubing about 70 per cent went to the railroads, almost entirely for locomotive boilers, and 30 per cent for commercial boilers. Of the mechanical tubing it is estimated that the bulk was taken by the automotive industry and the remainder went for agricultural purposes, drilling outfits and scattered purposes.

Steel Chain

Important factors in the manufacture of iron and steel chain estimate that 1922 production was about 60,000 tons, compared with a "normal" production of 100,000 to 110,000 tons. Under so-called normal conditions iron chain forms about 10 per cent of the total, but in 1922 there was not much occasion to make iron chain on account of the small volume of shipbuilding, which ordinarily takes large tonnages of iron chain for anchor cables.

Of the steel chain manufactured in 1922 probably 40 to 50 per cent went into automobile tire chains; 5 to 10 per cent to new railroad equipment, and about 5 per cent for agricultural purposes. The remainder went to general railroad requirements, hardware distributers, steel mills and miscellaneous uses. In an ordinary year the railroads will consume 40 per cent of the production of chain for new equipment and for replacements.

Range Boilers Take 50,000 Tons of Steel

A considerable factor in the consumption of blue annealed steel sheets is the manufacture of range boilers, the estimate of a large manufacturer of these boilers being that about 1,250,000 are made a year, consuming between 50,000 and 60,000 tons of steel.

Range boiler manufacturers also make a variety of other tanks, such as large storage tanks for domestic water supply; combined air and water tanks for the same purposes; expansion tanks for hot water heating systems; air tanks for garages, and others. It is considered likely that the volume of this latter business would account for 25,000 to 30,000 tons of additional steel.

Other Avenues of Steel Consumption

Woven wire cloth manufactured in the United States requires about 25,000 to 30,000 tons of steel.

Production of splice bars, fish plates, tie plates, etc., varies from year to year, according to the demands of the railroads, and in 1922 was probably between 400,000 and 500,000 tons.

It is estimated by manufacturers of wood screws that the amount of steel used last year for this purpose was 30,000 tons.

Umbrellas represent about 6000 tons of steel annually.

Metal bottle caps are said to require 40,000 to 50,000 tons of steel a year.

The manufacture of steel saws in the United States requires from 20,000 to 25,000 tons of steel, and according to the figures received by THE IRON AGE this was approximately the consumption of this industry in 1922.

Metal lath manufacturers estimate that the total consumption of steel for this industry in 1922 was 48,000 tons.

DECREASED ACTIVITIES

Output of Brass, Bronze, Copper, and Allied Products Less in 1921 Than in 1919

WASHINGTON, Jan. 3.—The Department of Commerce announces that reports made to the Bureau of the Census show a considerable decrease in the activities of establishments engaged primarily in the manufacture of brass, bronze, copper, and allied metal products during the year 1921 as compared with 1919. The total value of products reported for 1921 amounted to $214,612,000, compared with $482,313,000 for 1919, a decrease of 55.5 per cent. In addition, products of this class to the value of $42,790,000 were reported in 1919 by establishments classified in other industries; corresponding figures for 1921 are not available at this time.

Of the 912 establishments reporting products valued at $5,000 and more in 1921, 158 were located in New York; 108 in Pennsylvania; 81 in Illinois; 79 in Ohio; 71 in Michigan; 64 in Massachusetts; 62 in New Jersey; 59 in Connecticut; 46 in California; 28 in Wisconsin; 25 in Indiana; 18 in Missouri; 17 in Maryland; 12 in Rhode Island; 11 in Washington; 9 in Minnesota; 8 in Colorado; 6 each in Kentucky and Texas; 5 each in Iowa and New Hampshire; 4 each in Delaware and Louisiana; 3 each in Alabama, Oregon, and West Virginia; 2 each in the District of Columbia, Kansas, Maine, Nebraska, Vermont, and Virginia; and 1 each in Florida, Georgia, Montana, Tennessee, and Utah. Connecticut, the leading State in the industry in 1921, reported 30.7 per cent of the total value of products in that year. The difference in the number of establishments at the two censuses is explained by the fact that some of those reporting in 1919 were out of business or idle in 1921, while others had so changed the character of their products as to require classification in some other industry.

The decrease in production has been accompanied by decreases in the number of persons employed, in the amount paid during the year in salaries and wages, and in the cost of materials used.

In January, the month of maximum employment, 42,386 wage earners were reported, and in July, the month of minimum employment, 37,025, the minimum representing 87.4 per cent of the maximum employment. The average number employed during 1921 was 39,832 as compared with 75,051 in 1919. The reports show that 4,894, or 12.3 per cent of the total (average) number of wage earners, were employed in establishments operating 44 hr. or less per week; 2806, or 7 per cent, in establishments operating between 44 and 48 hr. per week;6847, or 17.2 per cent, 48 hr. per week; 7385, or 18.5 per cent, between 48 and 54 hr. per week; 1580, or 4 per cent, 54 hr. per week; 15,976, or 40.1 per cent, between 54 and 60 hr. per week; and 344, or nine-tenths of 1 per cent, 60 hr. per week.

A 50 per cent stock dividend, payable in common stock, has been declared by the Chapman Valve Co., Indian Orchard, Mass. The dividend represents $500,000 and is a transfer of that amount from the surplus fund to the capital stock.

REFRACTORIES STEADY

Increased Activity and Higher Prices Probable in the Near Future

PITTSBURGH, Jan. 1.—Manufacturers of magnesite brick have found that sales at the prices named following the application of the Fordney tariff law were impossible and in their efforts to interest buyers have been obliged to cut prices about to buyers' valuations. The market now is quotable at $65 per net ton f.o.b. makers' works, this price representing a reduction of $10 a ton from what was named when the tariff became effective. There also has been a cut in the past week of $3.50 a ton on grain magnesite, which now is priced in large lots at $40 a ton. Taking off the duty of $11.50 a ton on imported material, results in a price of $28.50, which is about the price that prevailed before the tariff became a factor.

Other kinds of refractories are at the prices, which recently prevailed, but if the market shows a tendency in either direction, it is upward, due largely to the fact that the iron and steel industry, which is such a large source of outlet, is starting the new year with unusual promise of heavy operations over much of the first half of the year. This is expected to produce much activity in refractories and to strengthen prices, which softened considerably on blast furnace and open hearth furnace grades when the iron and steel business quieted down in the late fall.

We quote per 1000 f.o.b. works:

	High Duty	Moderate Duty
Fire Clay:		
Pennsylvania	$43.00 to $46.00	$38.00 to $41.00
Ohio	40.00 to 42.00	35.00 to 38.00
Kentucky	40.00 to 42.00	37.00 to 40.00
Illinois	43.00 to 45.00	40.00 to 42.00
Missouri	43.00 to 45.00	38.00 to 42.00
Ground fire clay, per net ton		5.50 to 8.00
Silica Brick:		
Pennsylvania		42.00
Chicago		47.00
Birmingham		48.00
Ground silica clay, per net ton		7.50 to 9.50
Magnesite Brick:		
Standard size, per net ton (f.o.b. Baltimore and Chester, Pa.)		65.00
Grain magnesite, per net ton (f.o.b. Baltimore and Chester, Pa.)		40.00
Chrome Brick:		
Standard size, per net ton		50.00

Aluminum-Copper Alloys

The 92:8 aluminum-copper alloy, known in the trade as No. 12, can be trusted to have an ultimate strength of 18,000 lb. per sq. in. and an elongation of 1 to 1.5 per cent in 2 in., according to Robert J. Anderson, metallurgist, in Technical Paper No. 287, just issued by the U. S. Bureau of Mines. Experiments made by the Bureau in the preparation of No. 12 alloy do not indicate that one rich alloy is any better than another for introducing copper, as regards dross losses and gas consumption. Small heats of No. 12 alloy may be made conveniently and cheaply by using light-gage copper sheet or punchings; the solid copper should be added to the liquid aluminum, whereupon it will alloy at relatively low temperatures. Where production is large, as in a foundry pouring 25,000 to 50,000 lb. of castings in 10 hr., it is safer to employ a rich alloy. The most convenient rich alloy available, taking into consideration brittleness, melting point and ease of calculation, is the 50:50 alloy.

The most desirable method of making up a heat is to charge all the materials together. Technical Paper No. 287 may be obtained from the Bureau of Mines, Washington.

DEMAND IS ACTIVE

Valley Sheet Mills Well Supplied with Orders—Pig Iron Price Trend Upward

YOUNGSTOWN, Jan. 2.—Valley independent iron and steel makers report a well-sustained demand for their products over the first half of next year. Some of the important sheet makers say they now have enough orders on their books, covering the first quarter, to maintain production at an 80 per cent level. The action of one interest in announcing an advance of $3 per ton on all grades of sheets resulted in considerable business being placed, at the old levels, especially of one-pass black sheets and blue annealed grades.

Most makers, however, are endeavoring to stabilize the market at 2.50c for blue annealed, 3.35c for black and 4.35c for galvanized sheets, and forward commitments are being freely accepted at these prices.

Valley pipe makers are in especially comfortable position and pipe departments are running at a rate near normal. The pipe department of one Valley interest, normally employing 1600 workmen, was 300 men short one day last week following the holidays. While a shortage still exists, particularly of common laborers, it is not so general as the instance referred to might indicate.

One district pipe interest is filling an order for 85 miles of 10-in. pipe, involving 9000 tons, placed by the Texas Co. Numerous inquiries are before makers and business is coming through in substantial tonnages. Jobbers are active factors in the present market and are buying freely to replenish stocks against spring demand.

Prices of sheet bars and billets are stiffening and Valley makers of semifinished steel claim to be adhering to a $37 minimum. The Brier Hill Steel Co. recently marked up prices of sheet bars to $38.50, which represents the maximum of the present market.

Because of the stiffening in coal and coke prices, which are up 50c to $1 per ton, pig iron is moving toward higher levels, all grades being affected. Merchant blast furnace interests are well booked ahead, but complain that much of their business was booked at prices below prevailing levels.

Standard basic is now quotable at a minimum of $26 in the Valleys, while No. 2 foundry is held at $27, with some interests asking $28.

Following a long run of its open-hearth furnaces, the Trumbull Steel Co. has undertaken repairs. One of its seven units is idle for this reason and another will go down as fast as one is rehabilitated.

Finished Iron and Steel, Chicago

1922	Common Bar Iron, Cents	Soft Steel Bars, Cents	Structural Steel, Cents
January	1.60	1.60	1.60
February	1.575	1.525	1.525
March	1.575	1.55	1.55
April	1.625	1.60	1.60
May	1.67	1.66	1.66
June	1.74	1.75	1.75
July	1.85	1.75	1.75
August	2.11	2.05	2.05
September	2.25	2.10	2.20
October	2.50	2.10	2.20
November	2.50	2.10	2.20
December	2.35	2.10	2.20

Yearly Averages			
1921	2.12	2.16	2.225
1920	3.72	3.34	3.22
1919	2.68	2.74	2.79
1918	3.50	3.08	3.18
1917	3.77	3.772	4.275
1916	2.31	2.94	2.83
1915	1.24	1.48	1.48
1914	1.06	1.32	1.34
1913	1.43	1.55	1.60
1912	1.32	1.42	1.46
1911	1.22	1.47	1.50

Yearly Averages			
1910	1.45	1.62	1.66
1909	1.43	1.50	1.59
1908	1.56	1.66	1.82
1907	1.78	1.77	1.87
1906	1.71	1.68	1.86
1905	1.65	1.65	1.78
1904	1.41	1.50	1.71
1903	1.65	1.72	1.75
1902	1.71	1.73	1.75
1901	1.58	1.58	1.70
1900	1.75	1.75	2.00

FABRICATED STEEL BUSINESS

Principal Awards of the Week and Fresh Inquiries Which Have Appeared

Among the fabricated steel awards of the past week are the following:

Metropolitan storage warehouse, Amsterdam Avenue, New York, 1000 tons, to Hay Foundry & Iron Works.

Apartment building at 580 Park Avenue, New York, 1200 tons, to Hedden Iron Construction Co.

Emerson Shoe Co. office building, 1431 Broadway, New York, 385 tons, to A. E. Norton, Inc.

Stagg telephone exchange, Brooklyn, 300 tons, to Levering & Garrigues Co.

Great Northern Railway, deck and through plate girder spans, 1210 tons, to American Bridge Co.

Alterations to National League Ball Park, Chicago, 397 tons, to Vanderkloot Iron Works.

High school, Mt. Clemons, Mich., 332 tons, to Indiana Bridge Co.

Chicago, Burlington & Quincy, one 60-ft. and one 50-ft. through plate girder span, near Dunlop, Mo., 106 tons, to American Bridge Co.

Insurance Exchange Building, Boston, 3000 tons, to New England Structural Co.

Cotton Mill for Sand Springs Supply House, Sand Springs, Okla., 400 tons, Worden, Allen Co., Milwaukee, low bidders.

Pettibone-Mulliken Co., Chicago, three additional plant buildings, 1400 tons, to Duffin Iron Works.

Texas Co., oil tanks, Arkansas, 1800 tons, to an unnamed fabricator.

Guilbert Building, Seventh Avenue and Thirty-seventh Street, New York, 4400 tons, to Levering & Garrigues Co.

New York Central, bridgework, 500 tons, to the American Bridge Co., 275 tons to the Shoemaker, Satterthwait Bridge Co., and 575 tons to the Mount Vernon Bridge Co.

Apartment, 100th Street and Broadway, New York, 900 tons, to Taylor-Fichter Steel Construction Co.

Storage warehouse, Grand Concourse and 181st Street, 700 tons, to A. E. Norton, Inc., New York.

Six barges, 900 tons, to Howard Shipyards & Drydock Co., Jeffersonville, Ind.

Highway bridge, Colorado Springs, Colo., 200 tons, to Omaha Steel Works.

Structural Projects Pending

Inquiries for fabricated steel work which may be added to lists of pending projects include the following:

School, Beverly, Mass., 600 tons.

Press Building, Portland, Me., 300 tons.

Chicago, Burlington & Quincy, Wood Street and Ohio Street viaducts, Aurora, Ill., 425 tons, bids taken.

War Memorial Building, Nashville, Tenn., 800 tons, bids close Jan. 10.

Neil House, Columbus, approximately 2500 tons, bids to be taken shortly.

United States Radiator Corporation, Edwardsville, Ill., 140 tons.

High school, Wichita Falls, Tex., Knepke & Schaeffer, Oklahoma City, Okla., general contractors.

Lehigh & New England Railroad, 7 bridges, 400 tons,

Mercantile building, Seventh Avenue and Thirtieth Street, New York, 1400 tons.

Apartment, Fifth Avenue and Tenth Street, New York, 1400 tons.

Elks memorial building, Chicago, to cost $3,000,000, plans to be out next month.

Spencer Building, Cleveland, 300 tons.

Eugene W. Smith, the Crane Co., Chicago, will deliver an address on Jan. 20, before the Quad-City Foundrymen's Club, an organization made up of representatives of the foundry industry in Davenport and Bettendorf, Iowa; Rock Island, Moline and East Moline, Ill. Mr. Smith will describe and demonstrate his method of testing foundry sand by vibratory precipitation. He addressed the Chicago Foundrymen's Club on the same subject on Dec. 9, as reported in THE IRON AGE of Dec. 28, page 1725.

RAILROAD EQUIPMENT BUYING

Year Ends with Purchases of Upward of 12,000 Cars and Numerous Fresh Inquiries

The Baltimore & Ohio has closed on 5000 cars and the Southern Pacific has awarded a total of 4554 cars besides arranging to build 300 in its own shops. Other round car orders are settled substantially at this writing. The developments of the week were as follows:

The Baltimore & Ohio car orders were: 1500 hopper cars with the Pressed Steel Car Co., 1000 with the American Car & Foundry Co. and 500 each with the Standard Steel Car Co., the Youngstown Steel Car Co. and the Ralston Steel Car Co. It also ordered 1000 gondola cars from the Midvale Steel & Ordnance Co., and is about to close on 2000 box cars.

The Southern Pacific awards were: 3700 box cars to the Standard Steel Car Co., 504 stock cars to the Pullman Co. and 350 flat cars to the Ralston Steel Car Co. It will construct 300 flat cars in its Houston, Tex., shops.

The Great Northern is inquiring for 100 12,000-gal. tank cars and is considering leasing 100 tank cars for a period of one to three years. It also has an inquiry for 1000 box cars.

The United Fruit Express is inquiring for 100 refrigerator cars.

The Grand Trunk is in the market for 1000 automobile and 1000 box cars.

The Virginian is inquiring for 500 to 1000 120-ton composite steel gondola cars.

The Canadian National is inquiring for 20 milk cars.

The Imperial Coal Co. is in the market for 1000 hopper cars.

The International Coal Corporation is inquiring for 50 hopper cars.

The Western Pacific is asking for prices on 28 passenger cars.

The Union Pacific is inquiring for 59 passenger cars.

The New York Central is in the market for 9 passenger cars.

The New York Consolidated Railway Co. is inquiring for 50 all-steel passenger cars.

The Chicago, North Shore & Milwaukee is in the market for 50 gondola cars.

The Elgin, Joliet & Eastern is inquiring for 500 to 1000 gondola cars.

The Atchison, Topeka, & Santa Fe has placed an order with the Baldwin Locomotive Works for 18 locomotives.

The Chicago & Northwestern has placed 1000 box cars each with the American Car & Foundry Co. and the General American Car Co. and 200 express refrigerator cars with the Pullman Co. The road still has 1000 box cars to place.

Large Order for Planers

One of the largest orders for frog and switch planers closed in some time has been given by the Ramapo-Ajax Corporation, Hillburn, N. Y., calling for delivery of eight in various sizes up to 30 ft. long and 36 in. wide. The order was booked by the McCabe-Sheeran Machinery Corporation, 50 Church Street, New York, Eastern representative of the Liberty Machine Tool Co., Hamilton, Ohio.

Chester, Pa., Shipyard Abandoned

The Merchant Shipbuilding Corporation has announced that its shipbuilding plant at Chester, Pa., will be abandoned and all shipbuilding and steel fabricating work will be concentrated at the yards of the William Cramp & Sons Ship & Engine Building Co., Philadelphia, the latter company also being a Harriman interest. The future of the plant at Chester has not been determined.

The Bethlehem Steel Co. will build a new battery of coke ovens at its Lackawanna plant, and other manufacturers are figuring on coke pushers, cars, etc., for this installation. The Columbia Steel Corporation has sent out inquiries for by-product coke ovens and auxiliary equipment for its proposed installation in Utah, and for equipment required in extending its open-hearth plant in Pittsburgh, Cal.

ESTABLISHED 1855

THE IRON AGE

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Looking Forward

Most of the business surveys printed at the year-end have taken a favorable view of the prospects for 1923. It is rather the rule to do this in writing of a new year, and the industrial revival of 1922 has given fair warrant for optimism. The studies of economists and the various curves and indices resulting therefrom have been showing improvement for a good many months and the trend promises to hold for some distance into the new year.

The steel trade, in spite of the serious handicaps of the coal miners' and railroad strikes, made a good recovery last year in volume of business. With a 70 per cent increase over the 1921 output, 1922 closely duplicates 1919 in amount of steel produced —between 33 and 34 million tons of ingots and between 24 and 25 million tons of finished rolled steel. The month of December has shown little of the usual year-end let-down. There has been an unexpected amount of December buying and prices as well as production have held up better than was commonly looked for one or two months ago. With more than 100,000 cars on their books carried over into 1923, the car builders may not take new contracts in the next three months at the rate of the last three. It may also be said that the peak of the home building movement was reached in 1922. But in both these important feeders of the steel mills there are indications of continued good demand in 1923, and as is pointed out in the comment on page 53 under "The Outlook," the surface promises in a number of other consuming lines are admittedly favorable.

Commonly when the outward aspect of the steel business is not satisfactory, recourse is had to the assurance that "underlying conditions are sound." Today, when the rate of mill operations and volume of orders booked are the best in more than two years, it is the want of full assurance as to underlying conditions that tempers optimistic prophecy. Labor scarcity, various labor uncertainties, high fuel and high transportation, and the effect upon consumption of the higher prices for steel to which these various factors point are considerations which are not being ignored. On the face of things, after having averaged 1.50 cents on the bulk of their heavy-product shipments in 1922, the steel companies should work out of their hard conditions on the 2-cent basis for such products, which they are now seeking to establish. The question on which light will be thrown only as history is made in the new year is whether the country will take enough steel at 2 cents in 1923 to bring the industry to a state of real prosperity.

Ten Years of Electric Steel

The history of the electric furnace in steel making is a fine commentary on American initiative and accomplishment. Our annual review of this industry, given elsewhere, represents ten years of progress. In 1913, when the review was started, only 19 electric furnaces were credited to the American steel industry; as 1923 opens the number is over 400. In 1913 Germany led, with other foreign nations not far behind. With a late start the American industry forged rapidly to the front and today leads the world not only in furnace installations but in production.

The most striking advance in the record of the last ten years is that of the electric steel casting industry. Only an analysis of the statistics fully reveals this. In 1921 for the first time the electric steel casting output exceeded that of ingots, and also for the first time the electric steel castings tonnage was far in excess of the combined outputs of converter and crucible castings. Even in 1920 steel castings from electric furnaces exceeded those from converters and crucibles by about 50,000 tons. In 1913 the situation was the reverse, with the electric steel foundries producing less than one-tenth of the total from converters and crucibles. The electric furnace has established itself as the chief melting medium for small castings.

In respect to heavier steel products the showing is not so good. While larger and larger furnaces have been built, the largest are not now operating. But this lapse is regarded as only temporary. Another ten years will see the 100-ton electric furnace, but probably used as a duplexing unit.

The upheaval due to the war has retarded progress in the electric furnace industry less than in any other steel-making field. In the light of the exhibit on other pages, Dr. John A. Mathews, a

pioneer in the commercial development of this industry, was quite within bounds in his prophecy to the American Iron and Steel Institute last October: "When users acquire a full appreciation of what clean, sound steel means in terms of national efficiency, safety and economy, we shall see more rapid growth than has yet been seen. Its [the electric furnace's] usefulness to engineering and industry has just begun."

Steel Making Profits in 1923

While the new year follows the old year without any change in the rate of steel mill operation or in market prices of steel products, the continuance of present output and prices promises some measure of profit for the steel-making industry, while the results in 1922 were very unsatisfactory.

It has often been said that it requires the lapse of six months or more of active times before the steel producers reach a stage of fair earnings, both because old and low-priced orders have to be filled after the market has advanced and because expense is involved in putting additional units into operation. These influences were felt in 1922 and others also.

Present finished steel prices average slightly more than $10 a ton above the low levels, reached in August, 1921, in the case of sheets, in December of that year in tubular goods and in February or March of 1922 in the case of other products. About one-half of the advance, roughly speaking, is absorbed by higher wages and higher fuel costs, there being a slight offset in the reduction in freight rates of July 1, 1922.

In steel making, the year 1922 may be divided roughly into three parts. In the first three months there was rapidly increasing production. In the next six months operations were limited by fuel supply, with fairly steady production except for a sudden decline and recovery late in the period, while in the last three months there was steady production at a rate some 15 per cent above the average rate in the preceding six months and more than double the average rate of 1921. From April to August fuel costs rose and the coal strike settlement fastened high fuel costs upon the industry for an indefinite time. On Sept. 1 there was a general wage advance of 20 per cent in the steel industry.

The low-priced business on books of steel mills April 1 would have involved little if any profit in many cases if costs had not increased, but continually mounting costs were encountered, and a particularly unfortunate circumstance was that on account of restricted output in the summer some very low-priced business was carried beyond Sept. 1, having to be filled eventually at costs that had not been dreamed of when the orders were taken.

The same conditions as to market prices, rate of production and manufacturing costs that existed in the last three months of 1922 promise better earnings returns in the first three months of the new year than could be realized in the past quarter. The mills are running smoothly and have completed substantially all of the lowest-priced business. The income is increased while the outgo is not increased.

It is unfortunate that there is no assurance of an indefinite continuance of present conditions. There looms the possibility of a coal strike three months hence. In the judgment of some observers the balance of probability is that there will be a strike. Obviously a strike would be an unfavorable influence, but it is possible that just one more strike, or attempted strike, will be sufficient to bring about permanently improved conditions as to the production and marketing of coal. Apart from the threatened disturbance in that quarter the momentum the steel-consuming industries have attained will carry the steel industry well for some time to come.

Good Sheet and Tin Plate Tonnage

Tin plate being an article of common everyday consumption, its production has not shown the vicissitudes from year to year that have been seen in some other steel products, such as are bought largely for essentially investment purposes. To a large extent sheets occupy a similar position. There was not a little buying of rails and rolling stock in 1922, but this was largely for production in 1923. On the whole sheets and tin plates made relatively a good percentage showing.

The production of sheets last year was about 75 per cent of nominal capacity and the production of tin plate about 70 per cent, considering nominal capacity to be full capacity for one week multiplied by 52 weeks, it being recognized that full operation throughout a twelvemonth is practically impossible. Production of steel ingots was in the neighborhood of 64 per cent of capacity, taking capacity to be the actual output made in 1916 plus a conservative allowance for new construction, giving a present capacity of 52,000,000 tons.

Until the disturbing factor of the world war entered, tin plate production never fell in any one year more than 14 per cent below its best previous record, that occurring in 1913; the next greatest recession was in 1907, 11 per cent. Efforts during the war to insure an ample supply of tin plate were so successful that on Nov. 1, 1918, there was a stock of about 8,000,000 base boxes, or about three months of normal production, an outcome being that 1919 production was 24 per cent under the previous record. Late in 1920 and in the early part of 1921 holders of goods in tin plate containers refused to liquidate and take the necessary losses, the result being that production of tin plate in 1921 was 47 per cent under its previous record.

There are four general outlets for tin plate, or more strictly tin and terne plate, the regular domestic consumption, in the packing of fruit, meat, fish, vegetables and other articles, in direct exports, in making containers for exported oil and in terne plate for roofing. The regular domestic consumption in 1922 undoubtedly was considerably higher than in any previous year. Exports were less than 100,000 tons, against more than

200,000 tons in each of the five years 1916 to 1920 inclusive. Oil exports were rather moderate. There was unusually great consumption of terne plate, on account of the boom in garage and dwelling house construction. The net result was a production of about 1,400,000 gross tons, equal to about 33,000,000 base boxes, against the record output of 1,512,146 tons in 1917, and more than 1,400,000 tons in both 1918 and 1920.

While ordinary manufacturing activity, involving the consumption of sheets, was at nothing like a high level in 1922, the building boom called for large tonnages of sheets for lathing, ceiling and eaves trough and conductor pipe, while road building caused a fair demand for corrugated culvert. Easily the greatest single line of consumption was in the automobile industry with its new high record.

The production of sheets in 1922, including tin mill black sheets not tinned, as well as jobbing mill output, was probably in the neighborhood of 3,000,000 gross tons. The record output was made in 1920, with 2,519,072 tons of sheets 13 gage and lighter, 367,329 tons of sheets 12 gage and heavier and 246,816 tons of tin mill black, a total of 3,133,217 gross tons.

The outlook for 1923 in the sheet and tin plate industries is contained in the record of what occurred in 1922, for this merely established the pace. Stocks of canned goods are very moderate and the promise is of still heavier domestic consumption of tin plate. Activity in residential and garage construction continues, and the automobile industry expects to reach still higher levels of production.

A nearer approach to prosperity for the copper industry than it has known in a long time is indicated as the new year opens. The drastic liquidation which began late in 1920 and continued until early 1922 has run its course. Prices in 1921 fell below those of 1914, when the monthly average was 13.32 cents, and got down nearly to the 12.55-cent average of the low year, 1911. Even with the rapid advance in the last weeks of 1922, when electrolytic copper sold at 14.75 cents delivered, the year's maximum, the price stands well below the averages of 1912 and 1913, which were respectively about 16.50 cents and 15.50 cents. A year ago there were heavy stocks to be disposed of, but now they have been reduced close to normal. The year has been one of heavy exports. In the ten months ended with October shipments abroad were at a higher rate than for any year since the close of the war. The feature of this business has been the buying by Germany, which is credited with over 30 per cent of the total. There has been also increased buying by Italy, Sweden and China. Copper has had the unenviable distinction among metals of going to lower than pre-war levels. The course of tin, lead and zinc has been radically different. The recent recovery in copper is noteworthy, therefore, in the face of unfavorable conditions within the industry and of competition from substitutes and stainless products. Of the latter more will probably be heard in 1923.

CORRESPONDENCE

Amount of Zinc on Galvanized Sheets Largely Decided by Requirements

To the Editor: The article by Messrs. Singmaster and Halfacre of the New Jersey Zinc Co., which appeared in the October issue of *Mining and Metallurgy*, was written, quite naturally and properly, in the interest of increased consumption of zinc. It should be replied to only in an exhaustive treatise which would cover the entire subject, but the subscriber regrets that he is not in a position to devote the time necessary to prepare adequately such a work.

However, there are some weak or befogged points in the article that it might be well to point out. The gentlemen state that they carefully examined 50 samples of galvanized sheets of recent manufacture and found the weight of coating to vary from 0.62 to 1.9 oz. per square foot, with but five of the samples in excess of 1.50 oz. per sq. ft. Beyond being a mere statement of fact, this assertion proves nothing. Coating weights vary with the gage, and the gage of the sheets examined is not indicated. Neither do they state whether the material examined was manufactured as regular, tight coated, or special coated. If all the samples had been light gage material and had been coated on a lead and zinc pot, the tests would have shown much lighter coatings. If, however, they had been selected from material intended for culvert work, the tests probably would have shown all the coating weights to run over 1.50 oz.

Their next statement is that the majority of sheet buyers who order material manufactured to specifications call for a minimum of 2 oz. of coating per sq. ft. This is only partly true, as when culvert manufacturers are compelled to meet certain state highway specifications which call for a minimum of 2 oz. coating by spot test. Recent railroad specifications are showing considerable liberality, and there is one tentative specification of one of our largest systems which specifies the minimum coatings to run from 1.50 oz. for 9 gage, down to 1 oz. for 30 gage. The first draft of this proposed specification originally stated 1.25 oz. as a minimum for all gages. In other lines of manufacture the same trend can be noted.

The cause of this change of view is that the demands made by the fabricators of galvanized sheets are growing more and more severe. In an endeavor to supply a galvanized sheet that will not peel, the manufacturer is compelled to decrease the weight of the coating. The unfortunate thing is that zinc is a metal with very little elasticity, and consequently any stresses to which it is subjected result either in fracture or a badly strained condition. The thicker the coating on a sheet that is to be formed, the greater will be the strain at the surface and consequently the more marked the tendency of the coating to fracture or flake. By decreasing the thickness, the strain at the surface is lessened and this tendency is minimized. In other words, under such conditions it is a question of choosing the lesser of two evils.

The impression gained from a perusal of the article in question is that the manufacturer is in a position to reduce expenses by skimping the coating. This is true only within narrow limits, for nearly always, due to certain economic factors, there is a fairly nice adjustment between the prices of black and galvanized sheets which is balanced by the fluctuations in the price of spelter. There are well-established extras for the heavier coatings which are based on the prevailing quotations of zinc, and the manufacturer is always willing to apply coatings as heavy as required, though he would not feel himself called upon to guarantee them against flaking if subjected to very severe forming operations.

Another feature to be considered is the fact that improvements in galvanizing practice have resulted in a much more uniform distribution of the coating applied. It is apparent, of course, that a sheet on which the coat-

ing is equally distributed has a greater chance for long life than one on which the variation in thickness of the coating is considerable.

To sum up the whole situation, so long as the users of galvanized sheets continue to subject them to severe forming operations, and until there is developed a coating that will have the protective qualities of zinc and yet be elastic, the manufacturer of galvanized sheets must continue his present practice of meeting these conditions as best he knows how.

INLAND STEEL CO.,
Frank A. Weidman,
Special representative.

Chicago, Dec. 27, 1922.

Burning Mine Culm and Waste

To the Editor: Referring to the note in THE IRON AGE for Nov. 9, 1922, page 1225, by Mr. Frederick H. Scheffler, in connection with Mr. Britt's article published by you on Aug. 24, 1922, we can add the following information:

The feed water temperature during the tests averaged 86 deg. Fahr. and the steam pressure was 100 lb. (absolute), so that the total heat in the steam was 1186.3 B.t.u., with an approximate temperature of 328 deg. Fahr.

With the aid of these figures, and remembering that in France the evaporation is always given in kilograms of steam produced per kilogram of fuel from whatever the feed water happens to be, the actual test under reference produced 7.65 kilograms of steam at 100 lb. (absolute) pressure from feed water at 86 deg. Fahr., which gives an actual overall efficiency of 82.17 per cent.

The actual coal used during this particular test contained (by proximate analysis) 5650 calories per kilogram, equivalent to 10080 to 10170 B.t.u. per pound of coal. The information given herewith we believe should be of further interest to your readers, as the plant has proved conclusively that the fine dust and mine waste having high ash content can be successfully used in pulverized form. In fact, it has given a considerable impetus to the use of pulverized fuel in France.

W. O. RENKIN,
Managing engineer Quigley Fuel Systems, Inc.

New York, Dec. 26, 1922.

Domestic Manganese Ore Not in Demand

To the Editor: In an editorial on "The Ferromanganese Equation," in THE IRON AGE of Dec. 21, it is stated that "unless domestic output increases materially, importations must be on a larger scale."

If my own experience is any criterion, domestic producers of manganese ore do not find any desire for domestic ore. It does not appear that manufacturers of ferromanganese care for domestic supplies. Offers to contract to deliver a guaranteed tonnage of high-grade ore are not favored, even though they are based on a price in which the tariff has little weight. Six months ago, with manganese ore on the free list, when the seaboard price was 25c. per unit, we [American Ore Corporation, Duluth] were selling a 50 per cent ore at $22.50, f.o.b. our station, or at 45c. a unit. Seaboard quotations are now 29c. to 30c., to which duty is to be added, or a total of about 50c. An equivalent differential would give us 70c., if we should secure the full tariff advantage. We are not so optimistic as to expect it, but it would seem as though a fair part of the tariff advantage should be received by the American industry, for the development of which the manganese ore tariff was enacted.

You also say that "the principal result of the new tariff has been to advance the price of ferromanganese from $67.50 to $100 per ton, adding correspondingly to the cost of steel and not diminishing America's dependence."

This advance of $32.50 per ton in ferromanganese means an added cost per ton of steel amounting to about 25c., according to your own figure of 17 lb. ferromanganese to the ton of steel. Surely not a serious burden on steel.

An attempt to cooperate in developing America's manganese ore industry no doubt would aid in diminishing her apparent dependence on foreign supplies.

DWIGHT E. WOODBRIDGE.

Duluth, Minn., Dec. 26, 1922.

JAPANESE BUY TIN PLATE

Oil Company Takes 33,000 Boxes — Government Railroads Place Rails with American Mill

NEW YORK, Jan. 2.—Buying continued quiet in export until the end of the year, but the last few weeks of December were enlivened slightly by activity on the part of the Imperial Government Railways and the Nippon Oil Co., in Japan. China is still quiet and the few orders for sheets and wire that appear from South American markets are small.

The tender of the Nippon Oil Co., calling for bids on 33,000 boxes of oil size tin plate, the second purchase of this size in 1922, was placed with Mitsui & Co., and awarded by that company to the United States Steel Products Co. The tender of the government railroads, which called for 5000 tons of 60-lb. rails and 250 tons of splice bars, went to Suzuki & Co. and was awarded by that company also to the Steel Corporation's export subsidiary. The government railroads immediately issued another tender on an additional 5000 tons of 60-lb. rails and this, it is believed, has been placed.

The Chilean State Railways, 141 Broadway, New York, is in the market for a fair sized tonnage of sheets of rather unusual specifications, the width called for being 97 in., length 100 and 120 in. and thickness, 3/32 and 5/32 in.

As deliveries become more extended on domestic aluminum, importers with European connections in the aluminum trade feel that imports of German aluminum will again be profitable, at about ½c. per lb. under the current American quotation.

The market on Scotch foundry iron is moving upward and there are signs of further advances in price, according to recent cable reports to importers of foreign iron, as a result of a 2s. 6d. advance in the price of coal. Scotch foundry iron of about No. 3 grade is now quoted at £4 17s. 6d. to £5 ($22.62 to $23.20) per ton, f.o.b. steamship, Glasgow, and added to this is an increase in the ocean freight, which brings the rate to 15s. ($3.48) into Boston.

Labor Shortage at Youngstown

YOUNGSTOWN, Jan. 2.—Labor supply for Valley iron and steel properties has been augmented since the close of navigation on the Great Lakes by men who work on the boats during the summer. Employment managers in the Valley have scoured the entire Middle West, seeking workers, and have brought such men from points as far removed as Duluth.

In some cases, the steel companies are providing bunks and furnishing kitchens for the men. Some departments, such as tubular products, report a larger scarcity of men than others.

No Receiver for Wagner Mfg. Co.

ST. LOUIS, Jan. 2.—Circuit Judge Hall last Saturday dismissed the suit of several stockholders filed Nov. 18, asking for a receiver for the Wagner Electric Mfg. Co. The court also dissolved a restraining order prohibiting ratification of a reorganization of the business. Transfer of assets of the company to a new Delaware corporation was objected to by the petitioners.

The Lebanon Drop Forge Co., Lebanon, Pa., manufacturer of rivetless conveyor chains, will have its mail in the future sent to Avon, Pa., a suburb of Lebanon, where its plant has always been located.

DECEMBER IRON OUTPUT

Gain Last Month 4587 Tons Per Day as Compared with November

Fifteen Furnaces Blown In and Four Blown Out or Banked—Net Gain of 11.

The largest pig iron output of any month since October, 1922, is the record of the blast furnaces for December, the closing month of 1922. In October, 1920, the country's output was 3,292,597 gross tons. Last month's production was 3,086,898 tons. The December gain over November was about equal to the November gain over October, or 237,000 tons compared with 211,000 tons. There was also a substantial gain in furnaces blown in, although not so large as the gain registered in November. In December there were 15 furnaces blown in and four blown out, or a net gain of 11, which compares with a net gain of 26 in November. The increase in daily output of 4587 tons per day was a little less than half of the gain in daily rate of November over October.

Production of coke and anthracite pig iron for the 31 days in December, collected largely by telegraph, amounted to 3,086,898 gross tons, or 99,577 tons per day, as compared with 2,849,703 tons, or 94,990 tons per day in November, a 30-day month. This represents a gain of 237,195 tons over November, as compared with 211,859 tons as the gain of November over October.

The total number of furnaces in blast on Jan. 1 was 253 as compared with 242 on Dec. 1, with 218 on Nov. 1, with 172 on Aug. 1 and with 69 on Aug. 1, 1921, at the climax of that year's depression. A year ago, or on Jan. 1, 1922, the furnaces in blast were 125, so that one year later, or on Jan. 1, 1923, the number has been a little more than doubled. The capacity of the 253 furnaces in blast on Jan. 1 is estimated, without the usual detailed computation being made, at 101,200 tons per day, as compared with 97,135 tons per day for the 242 furnaces in blast on Dec. 1. This is an increase of 4065 tons per day. For the 125 furnaces in blast Jan. 1 a year ago, the estimated capacity was 53,735 tons per day.

The December production of 3,086,898 tons brings the total for 1922 to 26,880,383 tons. In 1921 the total was 16,543,686 tons.

The manganese-iron alloy output for December was 23,766 tons, of which 13,175 tons was ferromanganese and 10,591 tons spiegeleisen.

Daily Rate of Production

The daily rate of production of coke and anthracite pig iron by months, from December, 1921, is as follows:

Daily Rate of Pig Iron Production by Months—Gross Tons

	Steel Works	Merchant	Total
December, 1921	41,173	12,023	53,196
January, 1922	42,130	10,933	53,063
February	46,827	11,387	58,214
March	53,547	12,128	65,675
April	56,930	12,140	69,070
May	60,619	13,790	74,409
June	62,534	16,167	78,701
July	62,295	15,297	77,592
August	45,672	12,914	58,586
September	53,856	13,935	67,791
October	66,060	19,032	85,092
November	72,177	22,813	94,990
December	73,014	26,563	99,577

Among the furnaces blown in during December were the following: Harriet Y furnace in the Buffalo district; two Shoenberger furnaces of the American Steel & Wire Co. and No. 2 Lucy furnace of the Carnegie Steel Co. in the Pittsburgh district; No. 3 Shenango furnace in the Shenango Valley; the Emporium furnace in western Pennsylvania; the second Ashland furnace in Kentucky: No. 2 Mingo furnace of the Carnegie Steel Co. and No. 1 Riverside furnace of the National Tube Co. in the Wheeling district; No. 2 Hubbard furnace of the Youngstown Sheet & Tube Co. in the Mahoning Valley; No. 2 Joliet furnace of the Illinois Steel Co. and No. 9 Gary furnace in the Chicago district; E and F furnaces of the Colorado Fuel & Iron Co. in Colorado and No. 2 Bessemer furnace of the Tennessee Coal, Iron & Railroad Co. in Alabama.

Among the furnaces blown out or banked during December were the following: No. 4 Shenango furnace in the Shenango Valley; Tod furnace of the Brier Hill Steel Co. in the Mahoning Valley; one furnace of the Columbus works of the American Rolling Mill Co. in central Ohio and the Standard furnace in Tennessee.

Output by Districts

The accompanying table gives the production of all coke and anthracite furnaces for December and the three months preceding:

Pig Iron Production by Districts, Gross Tons

	Dec. (31 days)	Nov. (30 days)	Oct. (31 days)	Sept. (30 days)
New York	174,904	164,987	148,419	115,635
New Jersey	14,953	12,071	13,134	10,736
Lehigh Valley	57,892	64,889	63,635	55,711
Schuylkill Valley	79,271	71,861	66,232	41,646
Lower Susquehanna and Lebanon Valleys	37,834	36,004	32,374	25,440
Pittsburgh district	682,775	639,462	610,281	502,804
Shenango Valley	119,960	110,028	92,728	63,841
Western Penna.	153,901	127,682	116,508	68,140
Maryland, Virginia and Kentucky	83,815	70,030	54,856	44,136
Wheeling district	103,144	77,764	72,770	43,366
Mahoning Valley	343,095	321,188	302,434	218,363
Central and Northern Ohio	312,350	309,680	290,185	184,914
Southern Ohio	55,565	41,868	28,248	17,909
Illinois and Indiana	500,972	458,956	416,073	346,380
Mich., Minn., Mo., Wis. and Colo.	128,518	112,952	98,608	67,656
Alabama	218,301	209,006	210,994	204,802
Tennessee	19,648	21,275	20,365	22,241
Total	3,086,898	2,849,703	2,637,844	2,033,720

Production of Steel Companies—Gross Tons

Returns from all furnaces of the United States Steel Corporation and the various independent steel companies, as well as from merchant furnaces producing ferromanganese and spiegeleisen, show the following totals of steel making iron, month by month, together with ferromanganese and spiegeleisen. These last, while stated separately, are also included in the columns of "total production:"

Production of Steel Companies—Gross Tons

	Total Production			Spiegeleisen and Ferromanganese		
	1920	1921	1922	1920	1921	1922
Jan.	2,232,455	1,932,159	1,306,045	23,957	22,228	6,874
Feb.	2,181,679	1,625,695	1,311,170	28,038	29,013	8,540
Mar.	2,480,668	1,323,443	1,629,982	35,275	41,294	13,695
Apr.	1,968,542	1,015,621	1,707,902	27,628	24,310	19,209
May	2,128,720	1,024,678	1,879,180	33,407	9,232	20,334
June	2,209,770	883,312	1,876,033	34,751	4,536	23,090
July	2,230,567	715,664	1,931,138	36,789	5,524	26,049
Aug.	2,254,943	807,144	1,415,832	36,985	3,878	19,327
Sept.	2,247,250	815,692	1,615,696	39,546	3,289	14,916
Oct.	2,393,644	1,034,312	2,047,873	34,786	3,902	21,478
Nov.	2,150,075	1,138,789	2,165,295	26,944	3,525	17,424
Dec.	2,047,167	1,276,381	2,263,422	28,023	3,953	23,766

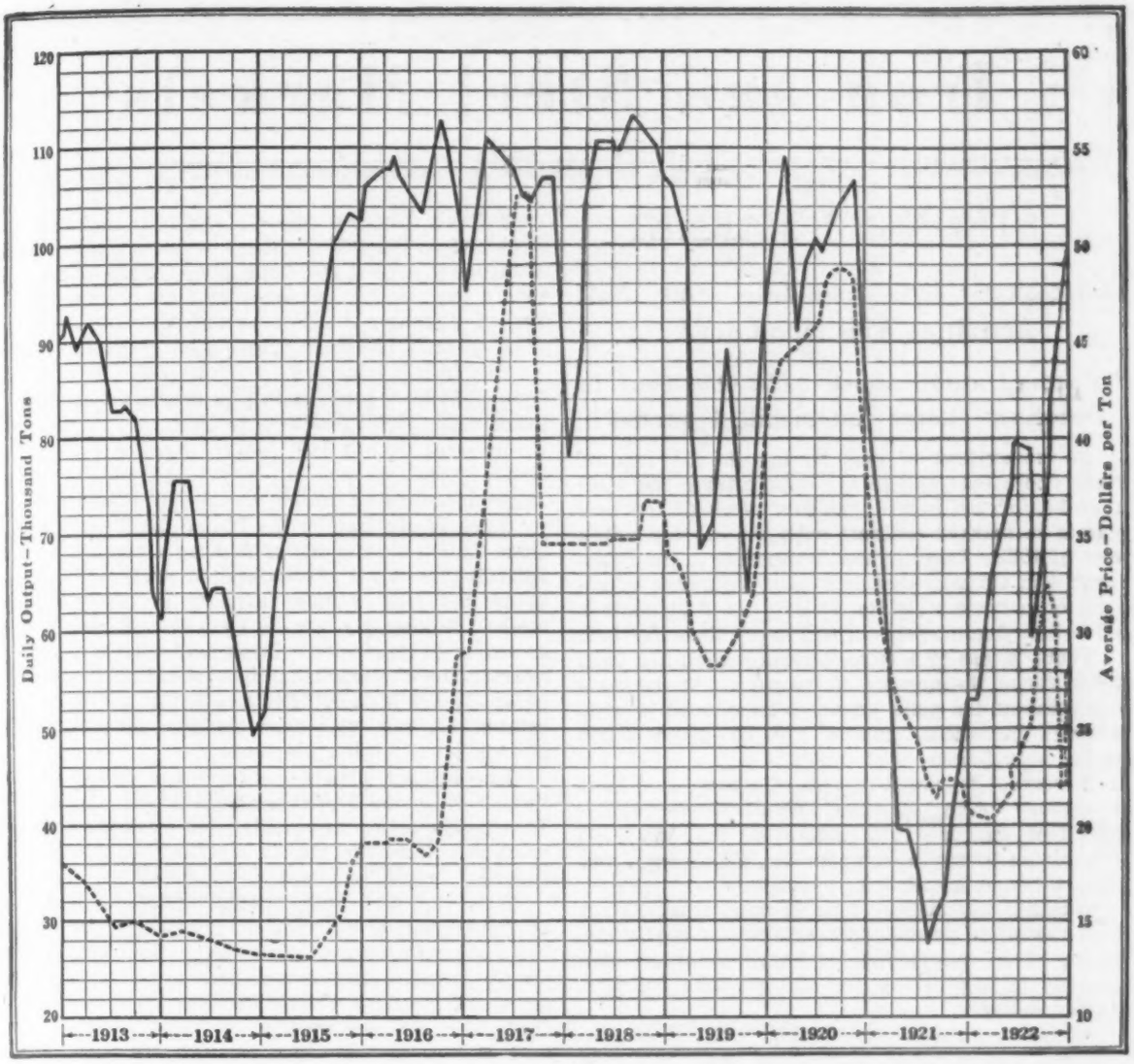
The figures for daily average production, beginning with January, 1916, are as follows:

Daily Average Production of Coke and Anthracite Pig Iron in the United States by Months Since Jan. 1, 1916—Gross Tons

	1916	1917	1918	1919	1920	1921	1922
Jan.	102,746	101,643	77,799	106,525	97,264	77,945	53,063
Feb.	106,456	94,473	82,835	105,006	102,720	69,187	58,214
Mar.	107,667	104,882	103,648	99,685	108,900	51,468	65,675
Apr.	107,592	111,165	109,607	82,607	91,327	39,768	69,070
May	108,422	110,238	111,175	68,002	96,312	39,394	74,409
June	107,053	109,002	110,793	70,495	101,451	35,494	78,701
July	104,017	107,820	110,354	78,340	98,931	27,889	77,592
Aug.	103,346	104,772	109,341	88,496	101,529	30,780	58,586
Sept.	106,745	104,465	113,942	82,932	104,310	32,850	67,791
Oct.	113,189	106,550	112,482	60,115	106,212	40,215	85,092
Nov.	110,394	106,859	111,802	79,745	97,830	47,183	94,990
Dec.	102,537	92,997	110,762	84,944	87,222	53,196	99,577
Year	106,665	104,619	105,496	83,789	99,492	45,325	73,645

Diagram of Pig Iron Production and Prices

The fluctuations in pig iron production from 1913 to the present time are shown in the accompanying chart. The figures represented by the heavy lines are those of daily average production by months of coke and anthracite iron. The dotted curve on the chart represents monthly average prices of Southern No. 2



The Full Line Represents the Daily Production of Pig Iron and the Dotted Line Is the Average of the Price Per Ton of No. 2 Southern Pig Iron at Cincinnati, Local No. 2 Iron at Chicago and No. 2X Iron at Philadelphia

foundry pig iron at Cincinnati, local No. 2 foundry iron at furnaces in Chicago, and No. 2X at Philadelphia. They are based on the weekly quotations of THE IRON AGE.

Production of Coke and Anthracite Pig Iron in the United States by Months, Beginning Jan. 1, 1918—Gross Tons

	1918	1919	1920	1921	1923
Jan.	2,411,768	3,302,260	3,015,181	2,416,292	1,644,951
Feb.	2,319,299	2,940,168	2,978,879	1,937,257	1,629,991
Mar.	3,213,091	3,090,243	3,375,907	1,595,522	2,035,920
Apr.	3,288,211	2,478,218	2,739,797	1,193,041	2,072,114
May	3,446,412	2,108,056	2,985,682	1,221,221	2,306,679
June	3,323,791	2,114,863	3,043,540	1,064,833	2,361,028
½ year.	18,002,572	16,033,808	18,138,986	9,428,166	12,050,683
July	3,420,988	2,428,541	3,067,043	864,555	2,405,365
Aug.	3,389,585	2,743,388	3,147,402	954,193	1,816,170
Sept.	3,418,270	2,487,965	3,129,323	985,529	2,033,720
Oct.	3,486,941	1,863,558	3,292,597	1,246,676	2,637,844
Nov.	3,354,074	2,392,350	2,934,908	1,415,481	2,849,703
Dec.	3,433,617	2,633,268	2,703,855	1,649,086	3,086,898
Tot. yr.	*38,506,047	30,582,878	36,414,114	16,543,686	26,880,383

*These totals do not include charcoal pig iron. The 1921 production of this iron was 94,730 tons.

The Wire & Steel Products Co., Inc., has moved from 417 East Twenty-second Street to 313 East Twenty-second Street, New York, where better facilities are available.

Detroit Scrap Market

DETROIT, Jan. 2.—The usual inventory period is being reduced to a minimum in this district so that melters will be able to keep pace with the heavy production schedules for the first quarter. The threatened shortage of labor is another factor that is forcing all manufacturers to take advantage of every working day. One of the largest scrap producers is offering about 3,000 tons of turnings, borings, flashings and regular hydraulic compressed on a competitive basis for January delivery. This letting will determine the firmness of the market and producers are anticipating prices in line with current pig iron quotations.

The following prices are on a gross ton basis, f.o.b. cars producers' yards, excepting stove plate, automobile and No. 1 machinery cast, which are quoted on a net ton basis:

Heavy melting steel	$14.50 to $15.50
Shoveling steel	15.00 to 16.00
No. 1 machinery cast	18.00 to 20.00
Cast borings	12.00 to 13.50
Automobile cast scrap	20.00 to 22.00
Stove plate	16.00 to 17.50
Hydraulic compressed	14.50 to 15.50
Turnings	11.50 to 12.50

Iron and Steel Markets

A STRONGER MARKET

Concessions Less Common and Mill Activities Well Maintained

Pig Iron Output Above 3,000,000 Tons in December—Large Automobile Contracts

In the amount of new buying, in the rate of works operations and in the expectations the steel trade has of the future, the first week of the new year is in marked contrast with the corresponding week of 1922. Leading steel companies in the Pittsburgh and Chicago districts have assurance of activity on a large scale for at least the first quarter and believe the momentum will carry them farther.

There is less of a buyer's market than had been looked for at the turning of the year. At the same time some of the price advances announced in wire products and sheets cannot yet be given much market significance.

In respect to plates, structural shapes and bars buyers are finding it more difficult to get concessions from 2c., and it is understood that the Steel Corporation is now holding for 2c., Pittsburgh, and 2.10c., Chicago, on all three products.

Substantially 200,000 tons of bars, sheets, strip steel and other products were taken in the recent buying of an automobile company. Another such company is negotiating for 150,000 tons for first quarter delivery.

Several railroads are buying lots of several thousand tons of plates, shapes and bars for repair and other shop work. The Pennsylvania, Reading and Norfolk & Western are in this list. A western Pennsylvania boiler works is in the market for 3500 tons of plates, and for the rebuilding of two blast furnaces at Cleveland 3000 tons of plates are wanted.

From 4000 to 5000 tons of plates will be needed for an order placed with the Youngstown Boiler & Tank Co. by an Arkansas oil interest, including 18 55,000-barrel oil tanks and a 5000-barrel refinery.

New car orders include 5000 for the Baltimore & Ohio, with 2000 more about settled, 4854 for the Southern Pacific and 2200 for the Chicago & Northwestern. The Santa Fe placed 18 locomotives with the Baldwin works.

Fabricated steel business is still good, 19,500 tons being awarded for 20 different projects, with fresh inquiries for 8500 tons, averaging over 700 tons each.

Sheet and tin plate mills are running well. The year starts with the American Sheet & Tin Plate Co. sold for the first quarter on sheets and for five months on tin plate. December bookings of independent producers are believed to have made a high record, such companies now having unfilled orders for about 500,000 tons, or over two months' production.

Pig iron output in December showed another marked gain—3,086,898 tons for 31 days, or 99,577 tons a day, while November, with a total of 2,849,703 tons, had a daily rate of 94,990 tons. December was the first 3,000,000-ton month since October, 1920.

Fifteen furnaces blew in and four blew out in December. The 253 furnaces active on Jan. 1 had a capacity of 101,200 tons a day against 97,135 tons a day for 242 furnaces on Dec. 1. The number of furnaces in blast more than doubled in 1922, as only 125 were running one year ago.

Pig iron production in 1922 was a little more than 27,000,000 tons, including charcoal iron, compared with 16,688,000 tons in 1921.

In steel output 1922 nearly duplicates 1919—about 33,500,000 tons of ingots and not far from 24,600,000 tons of finished rolled products.

Sales of pig iron in the Philadelphia market include 22,000 tons of basic, making a total of about 100,000 tons of all grades sold by eastern Pennsylvania and New Jersey furnaces in the last two weeks. Buying in other districts has not been large, as nearly all important melters have covered for first quarter, but the market is firmer and asking prices generally are higher. The new prices are not fully established, but with coke steadily advancing the outlook is for higher pig iron.

The leading export company has taken 10,000 tons of rails and 37,000 base boxes of tin plate for Japan. Exporters are looking for marked improvement in volume and prices in 1923. Prospects are reported bright in Great Britain also.

New iron and steel capacity under construction at the beginning of 1923 is somewhat more than the meager showing of a year ago. Seventeen open-hearth furnaces are planned for the new year, with an annual capacity of 819,000 tons. Only two blast furnaces are now scheduled for building this year, with annual capacity of about 330,000 tons. Last year eight open-hearth furnaces were completed, adding about 227,500 tons a year to steel capacity. Two blast furnaces were built, with estimated capacity of 320,000 tons of pig iron.

Pittsburgh

Outlook for First Quarter Very Satisfactory — Prices Are Firmer

PITTSBURGH, Jan. 2—If order books count for anything, steel companies in this district are assured of busy times for at least the first quarter of the new year, and it is not improbable that the momentum will carry them through the first six months of the year. There has been no material let down in orders, which have been coming to some manufacturers here in such volume that they are actually behind in entering them. There has been an attendant subsidence in the desire of the mills for additional bookings and with one or two exceptions the market now is best described as a sellers' affair.

Independent manufacturers of wire products either have withdrawn from the market for more first quarter business or are naming prices calculated to restrict new ordering. The new year starts with the American Sheet & Tin Plate Co. sold up for the first quarter of the year on sheets and for fully five months on tin plate, while December bookings of independent sheet makers are believed to have established a new high record and these interests have unfilled obligations of about 500,000 tons, or fully two months' production.

All makers of steel bars are heavily committed for the first quarter of the year and on plates and struc-

A Comparison of Prices

Advances Over the Previous Week in Heavy Type, Declines in Italics

At date, one week, one month, and one year previous

For Early Delivery

Pig Iron, Per Gross Ton:	Jan. 2, 1923	Dec. 26, 1922	Dec. 5, 1922	Jan. 3, 1922
No. 2X, Philadelphia‡	**$29.76**	$28.76	$29.14	$21.34
No. 2, Valley furnace†	27.00	27.00	25.50	19.50
No. 2, Southern, Cin'ti†	27.05	27.05	27.05	21.00
No. 2, Birmingham, Ala†	23.00	23.00	23.00	16.50
No. 2 foundry, Chicago*	28.00	28.00	28.00	19.00
Basic, del'd, eastern Pa.	26.75	26.75	27.50	20.25
Basic, Valley furnace	25.00	25.00	25.00	18.25
Bessemer Valley, del. Pitts.	29.27	29.27	31.77	21.96
Malleable, Chicago*	28.00	28.00	28.00	19.00
Malleable, Valley	27.00	27.00	27.00	19.50
Gray forge, Pittsburgh	28.27	28.27	26.77	20.96
L. S. charcoal, Chicago	33.15	33.15	36.15	31.50
Ferromanganese, furnace	100.00	100.00	100.00	60.00
Rails, Billets, etc., Per Gross Ton:				
O.-h. rails, heavy, at mill	$43.00	$43.00	$43.00	$40.00
Bess. billets, Pittsburgh	36.50	36.50	36.50	28.00
O.-h. billets, Pittsburgh	36.50	36.50	36.50	28.00
O.-h. sheet bars, P'gh	36.50	36.50	36.50	29.00
Forging billets, base, P'gh	**43.00**	42.50	45.00	32.00
O.-h. billets, Phila	*42.17*	43.17	43.17	33.74
Wire rods, Pittsburgh	45.00	45.00	45.00	36.00
	Cents	Cents	Cents	Cents
Skelp, gr. steel, P'gh, lb.	2.00	2.00	2.00	1.50
Light rails at mill	2.10	2.10	2.15	1.55
Finished Iron and Steel,				
Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Iron bars, Philadelphia	**2.325**	2.275	2.275	1.85
Iron bars, Chicago	2.35	2.35	2.35	1.60
Steel bars, Pittsburgh	2.00	2.00	2.00	1.50
Steel bars, Chicago	2.10	2.10	2.10	1.60
Steel bars, New York	2.34	2.34	2.34	1.88
Tank plates, Pittsburgh	**2.00**	1.95	1.95	1.50
Tank plates, Chicago	2.30	2.30	**2.30**	**1.60**
Tank plates, New York	**2.34**	2.29	2.29	1.83
Beams, Pittsburgh	2.00	2.00	2.00	1.50
Beams, Chicago	2.20	2.20	2.20	1.60
Beams, New York	2.34	2.34	2.34	1.88
Steel hoops, Pittsburgh	2.75	2.75	2.75	2.00

*The average switching charge for delivery to foundries in the Chicago district is 61c. per ton.
†Silicon, 1.75 to 2.25. ‡Silicon, 2.25 to 2.75.

Sheets, Nails and Wire,	Jan. 2, 1923	Dec. 26, 1922	Dec. 5, 1922	Jan. 3, 1922
Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Sheets, black, No. 28, P'gh.	3.35	3.35	3.35	3.00
Sheets, galv., No. 28, P'gh	4.35	4.35	4.35	4.00
Sheets, blue an'l'd, 9 & 10	2.50	2.50	2.50	2.25
Wire nails, Pittsburgh	2.70	2.70	2.70	2.50
Plain wire, Pittsburgh	2.45	2.45	2.45	2.25
Barbed wire, galv., P'gh	3.35	3.35	3.35	3.15
Tin plate, 100-lb. box, P'gh	$4.75	$4.75	$4.75	$4.75
Old Material, Per Gross Ton:				
Carwheels, Chicago	**$25.50**	$24.50	$24.00	$15.50
Carwheels, Philadelphia	20.00	20.00	20.00	16.50
Heavy steel scrap, P'gh	**21.00**	20.00	20.50	14.50
Heavy steel scrap, Phila	**18.00**	17.00	16.00	11.50
Heavy steel scrap, Ch'go	**18.50**	17.75	17.00	11.50
No. 1 cast, Pittsburgh	22.50	22.50	22.00	16.25
No. 1 cast, Philadelphia	**22.00**	21.00	20.00	16.50
No. 1 cast, Ch'go (net ton)	**21.00**	20.50	19.50	12.50
No. 1 RR. wrot., Phila	20.00	20.00	19.00	14.50
No. 1 RR. wrot. Ch'go (net)	**16.75**	16.25	15.00	10.50
Coke, Connellsville, Per Net Ton at Oven:				
Furnace coke, prompt	**$8.50**	$8.00	$6.50	$2.75
Foundry coke, prompt	**9.00**	8.50	7.50	3.75
Metals,				
Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Lake copper, New York	14.75	14.75	14.12½	13.87½
Electrolytic copper, refinery	14.50	14.50	13.75	13.62½
Zinc, St. Louis	**7.05**	6.95	7.10	4.82½
Zinc, New York	**7.40**	7.30	7.45	5.17½
Lead, St. Louis	**7.10**	6.97½	6.95	4.40
Lead, New York	7.25	7.30	7.30	4.70
Tin (Straits), New York	39.00	39.00	36.25	32.75
Antimony (Asiatic), N. Y.	6.25	6.25	6.40	4.50

The prices in the above table are for domestic delivery and do not necessarily apply to export business.

Composite Price, Jan. 2, 1923, Finished Steel, 2.446c. Per Lb.

Based on prices of steel bars, beams, tank plates, plain wire, open-hearth rails, black pipe and black sheets

These products constitute 88 per cent of the United States output of finished steel

Dec. 26, 1922,	2.439c.
Dec. 5, 1922,	2.439c.
Jan. 3, 1922,	2.062c.
10-year pre-war average,	1.689c.

Composite Price, Jan. 2, 1923, Pig Iron, $25.96 Per Gross Ton

Based on average of basic and foundry irons, the basic being Valley quotation, the foundry an average of Chicago, Philadelphia and Birmingham

Dec. 26, 1922,	$25.79
Dec. 5, 1922,	25.86
Jan. 3, 1922,	18.60
10-year pre-war average,	15.72

tural steel are more heavily obligated than they were recently, and delivery promises are becoming more extended. As far as this district is concerned, 2c. base, Pittsburgh, now is minimum and when the tonnage involved is small and prompt shipment is requested, premiums are demanded by some makers. There is a good deal of strength to the market, but it is more apparent in the difficulty attendant upon placing orders rather than in any actual price advances. There is a rather marked tendency away from giving buyers too much protection on plates, shapes and bars at today's prices.

Producers of pig iron are seeking still higher prices, but important melters became so well covered against their first quarter requirements by their December purchases that sales at the prices now asked are limited.

Fuel prices still show marked strength, largely as a result of the demands from the East for coke and soft coal in making good the shortage of anthracite. This, of course, is an important factor in the present price ideas of pig iron producers. Most of them are pretty well protected by contracts for their coke requirements for the first quarter of the year, but there is the danger that coke producers will not be able to fulfill obligations on account of labor or transportation conditions. There has been little change in plant operations in the past week, but it is still observed that finishing mill activities are not as heavy as those in raw materials, due to labor shortages. It is stated that a large independent steel company here could easily find work for 2000 additional men. The Shenango Furnace Co. has lighted its rebuilt No. 3 furnace. This brings the number of active furnaces in this and nearby districts to 101 out of a total of 139, the greatest number active since the early part of 1920.

Pig Iron.—Business of the week has been of moderate proportions, due chiefly to the fact that important consumers, notably of foundry iron, are well covered against their requirements for the present quarter of the year. Merchant furnace interests now are quite generally asking $28 for No. 2 foundry, at furnace, and a few small sales are reported to have been made at that price. Usually, however, that price has involved immediate shipment. It is very doubtful whether large tonnages could be sold at that price in spite of the well sold up condition of Valley furnaces, especially into the Pittsburgh district, because the Cambria Steel Co. only recently sold No. 2 grade at $25.50, Johnstown, and its present quotation is $26, the freight from Johnstown to Pittsburgh being $1.77 per ton, the same as from the Valley. Although as high as $26 now is asked by some Valley furnaces for basic iron, it develops that within

the past week 1000 tons was sold at $24.50, Valley Furnace, and $25, Johnstown, still can be done. We note sales of 500 tons of Bessemer iron to a Pittsburgh district sheet maker at $28, Johnstown, but a like tonnage of Valley Bessemer has been sold to a Pittsburgh steel foundry interest at $27.50. W. P. Snyder & Co. make the average price of Bessemer iron from Valley furnaces in December $28.098, as compared with $31.75 in November and on basic $24.567 against $27.60 in November.

We quote Valley furnace, the freight rate for delivery to the Cleveland or Pittsburgh district being $1.77 per gross ton:

Basic	$25.00 to $26.00
Bessemer	27.50
Gray forge	26.50 to 27.50
No. 2 foundry	27.00 to 28.00
No. 3 foundry	26.50 to 27.50
Malleable	27.00 to 28.00
Low phosphorus, copper free	36.00

Ferroalloys.—The market here has shown continued activity in the past week. Sales of ferromanganese aggregating 2000 tons have been made and fully 4000 tons more is under negotiation and likely to be closed shortly. Sales of about 1500 tons of spiegeleisen have been made to consumers in this district over the past week and it is said there is still much tonnage to be placed. Business in these materials has been at unchanged prices. Ferromanganese has commanded $100 at seaboard, or $104.79, delivered this district, for 80 per cent material, both domestic and British. Talk persists that the latter will be advanced, but as yet there has been no definite step in this direction. On 20 per cent spiegeleisen, the price varies from $33 to $35, furnace, according to the tonnage. Most users of 50 per cent ferrosilicon in this district have contracted for their 1923 requirements on a basis of $82.50, delivered, but the price of producers now is $85, with one maker asking that price at furnace.

We quote 80 per cent ferromanganese at $100, furnace, or $104.79 delivered Pittsburgh district for either domestic or British, and 76 to 80 per cent German at $67 c.i.f. Atlantic seaboard. Average 20 per cent spiegeleisen, $33 to $35, furnace; 16 to 19 per cent, $32 to $34; 50 per cent ferrosilicon, domestic, $82.50 to $85, delivered. Bessemer ferrosilicon is quoted f.o.b. Jackson and New Straitsville, Ohio, furnaces as follows: 10 per cent, $44.50; 11 per cent, $47.80; 12 per cent, $51.10; 13 per cent, $55.10; 14 per cent, $60.10; silvery iron, 6 per cent, $33; 7 per cent, $34; 8 per cent, $35.50; 9 per cent, $37.50; 10 per cent, $39.50; 11 per cent, $42; 12 per cent, $44.50; 13 per cent, $47. The present freight rate from Jackson and New Straitsville into the Pittsburgh district is $3.66 per gross ton.

Steel Skelp.—Current demands are rather moderate, but makers have entered contracts for a good deal of their probable first quarter production and are not so anxious for further business as to be willing to shade prices. The market is steady at 2c. for grooved or sheared pipe skelp, but for light gage material or boiler tube skelp, 2.15c. to 2.25c. is quoted.

Wire Products.—Several independent makers have followed the advance made by the Pittsburgh Steel Co. a week ago of $2 per ton on such first quarter business as now can be taken. The Youngstown Sheet & Tube Co. has made no formal announcement of an advance, but has withdrawn from the market on business for delivery over the next three months. The American Steel & Wire Co. has not followed the advance and probably will not, since it is practically sold up against production of the next 90 days. The advance, as far as sales are concerned, means little, as all producers were pretty well sold up before the change was made and the new prices merely constitute a delivery premium. The industry as a whole is operating about 75 per cent of capacity and with deliveries unimpeded so far by weather or railroad conditions, there is not much quick delivery business. Fence is not included in the advance. Prices are given on page 125.

Wire Rods.—This product is extremely firm and while a good many users are covered against their first quarter requirements at $45, base, there seems to be no tonnage available for late comers at less than $47.50 and we regard that price to be the market on current business. Makers have heavy obligations in finished products and between these demands and those of their rod customers already covered do not see much prospect of having much tonnage to sell over the first quarter of the year.

We quote No. 5 common basic or Bessemer rods to domestic consumers, $45 to $47.50; chain rods, $45 to $47.50; screw stock rods, $50 to $52.50; rivet and bolt rods and other rods of that character, $45 to $47.50; high carbon rods, $52 to $57.50, depending on carbon, per gross ton, f.o.b. Pittsburgh or Youngstown. Carbon rods command $3 over base for 0.20 to 0.40 carbon; $5 over base for 0.41 to 0.55 carbon; $7.50 over base for 0.56 to 0.75 carbon and $10 over base for over 0.75 carbon.

Billets, Sheet Bars and Slabs.—Makers are pretty well committed against production over the next three months and are inclined to seek higher prices on additional business. Advance to $38.50 for sheet bars, recently announced by a Youngstown producer, however, has not yet been followed by many other makers and there is doubt that sales can be made at that figure until a corresponding advance has been established in the finished products. Brokers are trying to place 10,000 tons of Bessemer slabs and there is an inquiry for 10,000 tons of sheet bars and a like tonnage of slabs from a central Ohio sheet maker. The National Tube Co. has made no additional purchases since its recent taking of 10,000 tons of Bessemer billets. Few steel makers are eager for forging billet orders and $43, base, is about as low as any of them will take business. Some sales are reported at $45, and as high as $47.50 is being asked.

We quote 4 x 4-in. soft Bessemer and open-hearth billets, $36.50; 2 x 2-in. billets, $36.50; Bessemer sheet bars, $36.50; open-hearth sheet bars, $36.50; slabs, $36.50; forging billets, ordinary carbons, $43 to $47.50, all f.o.b. Pittsburgh or Youngstown mills.

Sheets.—The leading interest is sold up for the first quarter of the year and independents rapidly are getting in the same condition. December business of the latter has been the heaviest of any month since the early part of 1920 and they begin the new year with unfilled tonnages of close to 500,000 tons. The Bethlehem Steel Corporation is sold up for the first quarter and has advanced prices $3 per ton on black and galvanized and $5 per ton on blue annealed, to 3.50c., base, for black, 4.50c., base, for galvanized and 2.75c., base, for blue annealed. A similar move by other independents is looked for as they get filled up. Some already are declining additional tonnage in galvanized sheets at 4.35c., but it is still easy enough to place black sheet business at 3.35c., base. Prices are given on page 125.

Steel Rails.—Conditions with light rails are much as last reported, both as to business and prices. Demand is steady, rather than active and while 2.15c., base, is the regular quotation of leading makers of new steel rails, there are occasional deviations. Light rails, rolled from old standard sections, are priced at 2c. Railroads tributary to Pittsburgh are taking out standard rails in accordance with the contracts made prior to Oct. 1 last, which provided for regular monthly specifications in return for acceptance of business at $40, when an advance to $43 had been announced.

We quote 25 to 45-lb. sections, rolled from new steel, 2.10c. to 2.15c. base; rolled from old rails, 2c. base; standard rails, $43 per gross ton mill for Bessemer and open-hearth sections.

Tin Plate.—The leading producer is sold up for the first five months of this year and the present bookings of independents will carry them at least through the present quarter. The market is strengthened by this condition and efforts of buyers to obtain supplies at more than the usual preferential discount have been unavailing. Standard Tin Plate Co., which has been operating 16 of its 24 hot mills for the past two months, went on full operating starting yesterday. Price is given on page 125.

Cold-Finished Steel Bars and Shafting.—There is a very good volume of orders accompanied by specifications at the regular price of 2.50c., base, Pittsburgh, for carload lots, and it is coming from widely scattered sources of outlet. Since the hot-rolled bar market seems to be well stabilized at 2c., there is increased talk of higher prices for cold-finished bars and an advance to 2.65c. is an early possibility, the claim being made that the differential should be more than $10 a ton, as at present. Ground shafting is firm and unchanged at 2.90c., base, f.o.b. mill, for carload lots.

Iron and Steel Bars.—The supply situation in steel bars is very firm, because so many makers are sold up for the first quarter of the year and are not anxious for additional tonnage. Shading of 2c. base has ceased. Iron bars also are firm at unchanged prices.

We quote steel bars rolled from billets at 2c.; reinforcing bars, rolled from billets, 2c. base; rail steel reinforcing bars, 1.90c. to 2c.; refined iron bars, 2.60c. in carloads, f.o.b. mill, Pittsburgh.

Tubular Goods.—There is no change in the situation; certainly, it is no easier as regard supplies. Demand for standard pipe, particularly the butt welded sizes, still exceeds production and even the ability of makers to supply. With expectations that 1922 building activity will continue and with no signs of any immediate decline in prices, distributors are extremely anxious to load up and are seeking much more tonnage than they ordinarily order, which is the basis of present allotments by the mills. To accept all the business offered, the mills would quickly become committed on production of standard pipe over the next six months and such a policy is not regarded as wise. Oil country pipe business is better, but relatively early delivery still is promised on new business. The Arkansas Natural Gas Co. is seeking prices on 130 miles of 12¾-in. line pipe. Boiler tube business shows no slackening and makers of lapwelded steel tubes are as much as three to four months behind their orders. Discounts are given on page 125.

Structural Material.—Mills are getting pretty well filled up and with deliveries becoming more deferred on new business, there is not only less tendency to shade the regular market price of 2c., but also a disposition on the part of the mills to be more cautious about protections. Structural interests here regard the outlook for spring building to be promising, but express fear that the demands of building trades may be such as to defer some projects now under consideration. Plain material prices are given on page 125.

Plates.—Desire of large users to be covered against their early 1923 requirements has resulted in filling up the mills in this and nearby districts for the next five or six weeks, and the virtual disappearance of prices below 2c., Pittsburgh. Possibly a large tonnage for extended delivery might be placed at slightly under 2c., but most mills are uninterested in current inquiries for early delivery at below that figure. Phoenix Iron Works, Meadville, Pa., is in the market for 3500 tons of plates. Prices are given on page 125.

Hot-Rolled Flats.—The market still is quotable from 2.75c. to 2.90c. base, Pittsburgh, according to the tonnage involved, the lower price prevailing on large tonnages. Makers here have sufficient business to carry them through most of the first quarter of the year, and are not anxious for additional tonnage at 2.75c. base. Sales of hot-rolled strips for cold rolling at 2.60c. base are said to reflect no weakness in the market, as those making cold-rolled strips usually enjoy a preferential price since they take the material practically as it comes off the mill. Prices are given on page 125.

Cold-Rolled Strips.—Makers are well supplied with orders and are getting a good volume of specifications. There is no change in price, the market holding at 4.50c. base, Pittsburgh.

Bolts, Nuts and Rivets.—Makers in this district report a satisfactory business and deny that it is necessary to shade prices to obtain orders or specifications. Prices and discounts are given on page 125.

Coke and Coal.—The market still is decidedly strong and higher prices have been established on coke because of the demands for heating and domestic purposes. The minimum today on 48-hr. beehive oven coke is $3.50 per net ton at ovens, and sales have been made from that price up to $9.25. On 72-hr. coke the ruling market is from $9 to $9.50 per net ton at ovens, and it is stated that as high as $9.75 has been paid on some tonnage for shipment to Canada. It must be understood that these prices are not being paid by either blast furnaces or foundries, but the market today is not being established by these interests. Soft coal appears to be quotable at $3.50 per net ton at mines for mine run steam; $4 for mine run coking and $4 to $4.25 for mine run gas.

Track Fastenings.—New business does not amount to much, but specifications on old orders are coming along in good shape. There is no change in prices. Quotations are given on page 125.

Old Material.—With one exception Pittsburgh melters still are inactive, but the one company which has been in the market has bought close to 10,000 tons of heavy melting steel, the tonnage being scattered among several dealers and representing long stocks. This business was all done at $21 and establishes the market at that level. There are reports that a Steel Corporation subsidiary recently bought a fair-sized tonnage of fancy railroad steel and paid at least $24, delivered, for it, but confirmation is lacking and it is believed that if the sale was made it was to dealers short of the market on tonnages for this company. Compressed sheets cannot be bought below $20 and melters say that $20.50 is the common asking price. The Pennsylvania Railroad is offering a total of 40,000 net tons of scrap from its four divisions and extremely high prices are expected to be paid on these lists, which close Jan. 4, as dealers are anxious to secure supplies against an expected heavy demand over the next few weeks.

We quote for delivery to consumers' mills in the Pittsburgh and other districts taking the Pittsburgh freight rate as follows:

Per Gross Ton	
Heavy melting steel (nominal)	$21.00
No. 1 cast, cupola size	$22.50 to 23.00
Rails for rolling, Newark and Cambridge, Ohio; Cumberland, Md.; Huntington, W. Va.; and Franklin, Pa.	20.50 to 21.00
Compressed sheet steel	20.00 to 20.50
Bundled sheet sides and ends	18.00 to 18.50
Railroad knuckles and couplers	23.00 to 23.50
Railroad coil and leaf springs	23.00 to 23.50
Low phosphorus standard bloom and billet ends	24.00 to 24.50
Low phosphorus, plates and other grades	23.00 to 23.50
Railroad malleable	20.00 to 20.50
Iron car axles	28.00 to 29.00
Locomotive axles, steel	23.00 to 24.00
Steel car axles	21.00 to 21.50
Cast iron wheels	22.00 to 22.50
Rolled steel wheels	22.50 to 23.00
Machine shop turnings	16.00 to 16.50
Heavy steel axle turnings	17.50 to 18.00
Short shoveling turnings	17.50 to 18.00
Cast iron borings	17.50 to 18.00
Heavy breakable cast	18.50 to 19.00
Stove plate	16.50 to 17.00
Sheet bar crop ends	22.00 to 22.50
No. 1 railroad wrought	18.50 to 19.00

Decision in Donner Steel Co. Case

WASHINGTON, JAN. 2.—Contention by the Interstate Commerce Commission that the Donner Steel Co., Buffalo, was not entitled to a mandamus compelling the commission to change its findings as to damages claimed to have been suffered through alleged discrimination against the steel company by several railroads in favor of subsidiary steel concerns was upheld today in a decision by the District Court of Appeals. It was held by the Court that there was no damage and that the decision of the commission in a proceeding of this kind is conclusive.

The Central Refractory Co. of Ohio, and the Refractory Co. of Pennsylvania, with plants at Newark, Ohio, and Belfont, Pa., engaged in the manufacture of brick and tile, have been merged, a Pennsylvania charter having been taken out capitalizing the company at $10,000,000. C. B. Young, Columbus, Ohio, is president of the corporation, Irves Harvey, Belfont, Pa., secretary, and W. W. Connell, Newark, Ohio, treasurer.

In a statement issued by Electric Arc Cutting & Welding Co., Newark, continued improvement in the welding of cast iron, is given as a notable development in arc welding progress in 1922. The successful welding of automobile cracked water jackets, crank cases, furnaces and similar work where thin cast iron welding without preheating have been previously considered practically impossible, is emphasized.

Chicago

Favorable Conditions at Opening of New Year —Orders for Nearly 10,000 Cars

CHICAGO, Jan. 2.—Rarely have Chicago steel mills entered a new year under such favorable circumstances. There was practically no let-up in buying during the holiday season, and the month of December as a whole proved equal to November both in specifications and in new business. Although the first quarter of 1923 is hardly begun, present commitments of local producers probably cover 90 per cent of their output in that period. As they become less able to take care of early delivery requirements, more business is being diverted to Eastern mills at Pittsburgh base prices. Pittsburgh quotations in turn are becoming increasingly firm and in some quarters a general advance in steel prices is regarded as an early possibility. A number of Eastern independents have already advanced sheets $3 to $5 a ton, plain wire 15c per 100 lb. and nails 10c per keg.

A review of the year just closed indicates that the bookings of Chicago mills were heavier than those of producers in other sections of the country. One leading local mill entered practically as much tonnage as during 1920. Considering operating difficulties, shipments were better than anticipated, although they failed to equal bookings by quite a margin. Railroad car buying, oil storage tank construction, automobile manufacture and building work all proved important feeders of tonnage to the mills. Building operations in Chicago and tributary sections were the best in history and another good year is looked for, unless labor costs discourage investors. The wages in some trades are now startlingly high and further advances might make building work prohibitive. To cite one example, plasterers in Chicago are earning as much as $30 a day and in some instances even more. A continuance of railroad car purchases is expected in view of large inquiries pending and the liberal orders placed during the last week of 1922. Agricultural implement manufacturers as well as the innumerable makers of other goods consumed on the farm will undoubtedly be favorably affected by the improvement in crop values, which are 30 per cent higher than a year ago.

Mill operations remain unchanged, with Illinois Steel Co. producing at the rate of 83 per cent of ingot capacity and Inland Steel Co. on a 75 per cent basis.

Ferroalloys.—Outside of a few carload orders for ferromanganese and spiegeleisen, the market has been quiet. It is rumored that ferromanganese will advance on account of exchange conditions.

We quote 80 per cent ferromanganese, $107.56, delivered; 50 per cent ferrosilicon, $80 to $82.50, delivered; spiegeleisen, 18 to 22 per cent, $46.05, delivered.

Pig Iron.—A surprising amount of spot business covering small lots ranging from carloads up to a few hundred tons was closed during the past week at prices ranging from $28 to $29 base, local furnace. As was to be expected between the holidays, forward buying was rather limited and few new inquiries appeared. A sale of 700 tons of malleable to a local melter for first quarter was among the few negotiated for that delivery. With the holidays past and inventory taking largely completed, action is expected on a considerable tonnage of iron still pending and new inquiries are looked for from other melters who have not yet covered for their first quarter requirements. Furnaces have comfortable backlogs and prices are firm. In fact, several spot sales have been made at $29 base, furnace, and we note one at as high as $30 base. A local buyer is in the market for 500 to 1000 tons of low phosphorus for Indiana Harbor delivery and a like tonnage for shipment to Chester, Pa. Both copper bearing and copper free material of foreign origin are available at $27.50, seaboard, or $35.06 delivered Chicago. Domestic low phosphorus is quoted as low as $37, delivered Chicago. A car wheel manufacturer on the Eastern seaboard is inquiring for 1000 tons of charcoal, while an Eastern steel company wants 500 tons. Charcoal appears firm at $30, furnace. A few carload sales of silvery have been made at the Jackson County prices quoted below. No large purchases of Southern iron are reported, but prices seem steady at a minimum of $23 base, Birmingham.

Quotations on Northern foundry, high phosphorus malleable and basic irons are f.o.b. local furnace and do not include an average switching charge of 61c. per ton. Other prices are for iron delivered at consumers' yards or, when so indicated, f.o.b. furnace other than local.

Lake Superior charcoal, averaging sil. 1.50, delivered at Chicago	$33.15
Northern coke, No. 1, sil. 2.25 to 2.75	$28.50 to 29.00
Northern coke, foundry No. 2, sil. 1.75 to 2.25	28.00 to 28.50
Malleable, not over 2.25 sil.	28.00 to 28.50
Basic	28.00 to 28.50
High phosphorus	28.00 to 28.50
Southern, No. 2	29.01
Low phos., sil. 1 to 2 per cent copper free	35.06 to 37.00
Silvery, sil. 8 per cent	40.29

Plates.—The placing of nearly 10,000 freight cars during the last week of December and the appearance of many new inquiries for rolling stock point to a continuation of an activity which accounted for an important share of mills' bookings in plates, shapes and bars during 1922. Local mills have little free tonnage left in this quarter and an increasing number of orders are being placed with outside producers.

The mill quotation is 2.10c. to 2.30c., Chicago. Jobbers quote 2.90c. for plates out of stock.

Rails and Track Supplies.—Except for specifications against contracts, the market is without features.

Standard Bessemer and open-hearth rails, $43; light rails rolled from new steel, 2.15c., f.o.b. makers' mills.

Standard railroad spikes, 2.85c. to 3c. mill; track bolts with square nuts, 3.85c. to 4c., mill; iron tie plates, 2.50c.; steel tie plates, 2.35c., f.o.b. mill; angle bars, 2.75c., f.o.b. mill.

Jobbers quote standard spikes out of warehouse at 3.50c. base and track bolts, 4.50c. base.

Bars.—Bookings of mild steel bars were fully as heavy in December as in the previous month. Practically no recession in buying occurred during the holidays and in view of the large tonnage now on the books of local mills, an increasing amount of business is going to Eastern producers who can make better deliveries. Bar iron sales show some improvement, but bookings are by no means comparable with those of mills rolling soft steel. Hard steel bars are also less active than mild steel. Purchases of rail steel by the farm implement makers have not been as heavy as was expected.

Mill prices are: Mild steel bars, 2c. to 2.10c., Chicago; common bar iron, 2.35c. to 2.50c., Chicago; rail steel, 2c., Chicago mill.

Jobbers quote 2.80c. for steel bars out of warehouse. The warehouse quotation on cold-rolled steel bars and shafting is 3.80c. for rounds and 4.30c. for flats, squares and hexagons.

Jobbers quote hard and medium deformed steel bars at 2.50c. base; hoops, 4.15c.; bands, 3.55c.

Cast Iron Pipe.—St. Paul, Minn., will take bids on 2000 tons of pipe Jan. 8, and on 190 tons of fittings Jan. 15. Hammond, Ind., has awarded 280 tons of 16-in. to the United States Cast Iron Pipe & Foundry Co. Prices are firm.

We quote per net ton, f.o.b. Chicago, as follows: Water pipe, 4-in., $55.20; 6-in. and above, $51.20; class A and gas pipe, $3 extra.

Wire Products.—Independents have rather generally advanced nails to $2.80 per keg and plain wire to $2.60 per 100 lb., base Pittsburgh. As yet there has been no intimation that the leading interest will follow. Demand, particularly for nails, has continued heavy through the holiday season. Fence business is also good. The leading producer is operating at from 65 to 70 per cent of capacity, but is still experiencing difficulty in taking care of specifications. For mill prices, see Finished Iron and Steel, f.o.b. Pittsburgh, page 125.

We quote warehouse prices f.o.b. Chicago: No. 9 and heavier black annealed wire and No. 9 and heavier bright basic wire, $3.30 per 100 lb.; common wire nails, $3.45 per 100 lb.; cement coated nails, $2.90 per keg.

Sheets.—The prices of local mills remain unchanged, but a number of important Eastern independents have advanced blue annealed $5 a ton and black and galvanized $3 a ton. It is undeniable that there has been a decided change in the position of the mills. Bookings of independents during December were fully two and one-half times those of November. Local mills are practically sold up for the quarter and are not expected to change their quotations immediately.

Mill quotations are 3.35c. to 3.50c. for No. 28 black, 2.50c. to 2.75c. for No. 10 blue annealed and 4.35c. to 4.50c. for No. 28 galvanized, all being Pittsburgh prices, subject to a freight rate to Chicago of 34c. per 100 lb.

Jobbers quote f.o.b. Chicago, 4c. for blue annealed, 4.85c. for black and 5.85c. for galvanized.

Bolts and Nuts.—Although business was less active between the holidays, specifications were fairly liberal and the closing of contracts for first quarter continued. Discounts are holding well, although occasional concessions are reported.

Jobbers quote structural rivets, 3.75c.; boiler rivets, 3.85c.; machine bolts up to ¾ x 4 in., 50 per cent off; larger sizes, 50 off; carriage bolts up to ⅝ x 6 in., 45 off; larger sizes, 45 off; hot pressed nuts, squares and hexagons, tapped, $2.75 off; blank nuts, $2.75 off; coach or lag screws, gimlet points, square heads, 55 per cent off.

Reinforcing Bars.—Lettings were less numerous between the holidays, but the amount of work pending or about to come up for figures points to heavy business during this quarter. About 2500 tons of bars will be required in the Stevens Hotel, Chicago, and it is intimated that a large tonnage is still to be bought for the new Ford plant at Hegewisch. Dealers are becoming concerned about their future supply of steel and anticipate that a considerable percentage of their requirements will have to be bought from mills outside of Chicago. For this reason it is felt that an advance in the warehouse price of concrete bars is inevitable. Recent awards include:

St. Louis County, Minn., road work, 1500 tons to Jones & Laughlin Steel Corporation.

Broadway Hotel, Chicago, 192 tons to Barton Spiderweb System Co.

Apartment building, Seventy-third Street and South Shore Boulevard, Chicago, 100 tons to Concrete Engineering Co.

Mt. Clemens, Mich., high school building, 150 tons to Concrete Steel Co.

Faddener garage, Chicago, 150 tons to Kalman Steel Co.

Prospective business includes:

Stevens hotel building, Chicago, 2500 tons.

Lion Oil Refinery, Eldorado, Ark., 125 tons.

Carpenter Building, Milwaukee, Wis., 500 tons.

Structural Material.—Fabricating awards were light during the last week of 1922, but inquiries pending and work still on architects' boards indicate that large building operations are ahead. Eastern mills are booking an increasing tonnage in plain material in this territory because of the heavy forward commitments of Chicago producers. The largest fabricating project pending is the Stevens Hotel, Chicago, involving 16,000 tons. Bids on the general contract are to be taken Feb. 1. The fabricating work was let some months ago to an Eastern company, but the failure of the buyer to exercise his contract within the time limits set, threw the tonnage on the market again.

The mill quotation on plain material is 2.10c. to 2.20c., Chicago. Jobbers quote 2.90c. for plain material out of warehouse.

Steel Castings.—Practically no business was placed during the holiday season, but a large tonnage is pending as the new year opens. The recent Baltimore & Ohio and Southern Pacific car orders alone will call for 24,000 tons in special castings and nearly 5000 tons in miscellaneous steel castings.

Old Materlai.—Consumer buying was light during the last week of 1922, but the market showed unusual strength as the result of activity among dealers. Purchases both to complete unfilled contracts and to accumulate stocks for later advances caused the prices of most grades to move up 50c to $1 a ton. This dealer demand has emphasized the scarcity of material by causing holders of scrap to keep their stocks off the market. It is believed, however, that there will be larger railroad offerings this month and this may tend to relieve the situation sufficiently to cause the unloading of yard holdings. The prices quoted below are nominal so far as consumers are concerned, as present activity is confined to brokers. Railroad offerings include the Pennsylvania, Northwestern Region, 3000 tons; the Pennsylvania, Southwestern Region, 5000 tons, and the New York Central, the Michigan Central and the Erie, blind lists.

We quote delivery in consumers' yards, Chicago and vicinity, all freight and transfer charges paid, as follows:

Per Gross Ton	
Iron rails	$22.00 to $22.50
Cast iron car wheels	25.50 to 26.00
Relaying rails, 56 and 60 lb.	26.00 to 27.00
Relaying rails, 65 lb. and heavier	32.00 to 35.00
Rolled or forged steel car wheels	23.50 to 24.00
Rails for rolling	19.50 to 20.00
Steel rails, less than 3 ft.	21.00 to 21.50
Heavy melting steel	18.50 to 19.00
Frogs, switches and guards cut apart	18.50 to 19.00
Shoveling steel	18.25 to 18.75
Drop forge flashings	13.50 to 14.00
Hydraulic compressed sheets	15.50 to 16.00
Axle turnings	16.00 to 16.50
Per Net Ton	
Iron angles and splice bars	22.00 to 22.50
Steel angle bars	18.00 to 18.50
Iron arch bars and transoms	22.00 to 22.50
Iron car axles	25.00 to 25.50
Steel car axles	18.50 to 19.00
No. 1 busheling	15.50 to 16.00
No. 2 busheling	10.50 to 11.00
Cut forge	16.00 to 16.50
Pipe and flues	13.00 to 13.50
No. 1 railroad wrought	16.75 to 17.25
No. 2 railroad wrought	16.50 to 17.00
Steel knuckles and couplers	21.50 to 22.00
Coil springs	22.50 to 23.00
No. 1 machinery cast	21.00 to 21.50
No. 1 railroad cast	19.00 to 19.50
No. 1 agricultural cast	19.00 to 19.50
Low phos. punchings	18.00 to 18.50
Locomotive tires, smooth	17.50 to 18.00
Machine shop turnings	11.50 to 12.00
Cast borings	13.50 to 14.00
Stove plate	16.75 to 17.25
Grate bars	17.50 to 18.00
Brake shoes	17.50 to 18.00
Railroad malleable	22.00 to 22.50
Agricultural malleable	22.00 to 22.50

New York

Liberal Buying of Finished Materials — Coke Continues to Advance

NEW YORK, Jan. 2.—The price of furnace coke has again advanced and quotations now range from $9 to $9.50, ovens, while foundry grades are sold from $10 to $10.25. Coke is moving very slowly on the railroads and the situation is serious in some centers. The tendency of coal prices is also upward with low volatile grades quoted at $5 to $6 at mines and high volatile coals at $4 to $4.50. By-product coke is still quoted at $14.84 to $14.91, Newark and Jersey City points. Furnace coke in large quantities is still being sold for domestic consumption as a substitute for anthracite.

Pig Iron.—Selling has been of moderate volume with probably the largest a 1000-ton lot, with a few 500-ton lots and numerous carload sales. The principal inquiry has been for 5000 tons of malleable from the Eastern Malleable Iron Co., but none of the tonnage was placed in this district. One seller who quoted on a basis of $28, eastern Pennsylvania, failed to get any of the business. The general price tendency is upward. The usual quotation in eastern Pennsylvania is $28 for No. 2 plain, $29 for No. 2X and $30 for No. 1X, but few sales have been made at these prices and it is probable that business could still be done on a basis of $27 for No. 2 plain. A sale of Scotch, equivalent to No. 2X, has been made at $29.50, but the market is quotable somewhat lower, while on Continental grades the usual range is $26.50 to $27, duty paid. Numerous embargoes have been declared, especially for delivery into New England. The railroad situation is very unsatisfactory.

We quote delivered in the New York district as follows, having added to furnace prices $2.27 freight from eastern Pennsylvania, $4.91 from Buffalo and $5.44 from Virginia:

East. Pa. No. 1 fdy., sil. 2.75 to 3.25	$31.27 to $32.27
East. Pa., No. 2X fdy., sil. 2.25 to 2.75	30.27 to 31.27
East. Pa. No. 2 fdy., sil. 1.75 to 2.25	29.27 to 30.27
Buffalo, sil. 1.75 to 2.25	30.91
No. 2X Virginia, sil. 2.25 to 2.75	33.44
No. 2 Virginia, sil. 1.75 to 2.25	32.44

Ferroalloys.—Considerable activity marks the ferromanganese market as the new year commences. Sales of several thousand tons in large and small lots are reported with substantial inquiries still before the market. The quotations remain unchanged. The sales referred to have been made largely by British producers, but the domestic product has also been a factor. Sales of spiegeleisen have also been fairly heavy for the first half of 1923 at current quotations and there are some good inquiries before the market. There have been no developments reported in the manganese ore market and no statistics of importations have been available since those issued for the period ended with Sept. 21. The 50 per cent ferrosilicon market is active and strong. Contracts for 1923 have been liberally negotiated by some consumers, while others have been holding off in the expectation of lower prices. Quotations vary, depending on the seller, the contract and the quantity, from $82.50 to $87.50. Contracts for ferrochromium for 1923 have also been liberally negotiated at 13c. to 14c. per lb. of contained chromium delivered. Quotations are as follows:

Ferromanganese, domestic furnace, per ton	$100.00
Ferromanganese, British, 80 per cent, f.o.b. Atlantic port	$100.00
Spiegeleisen, 17 to 19 per cent, furnace,	$34.00 to $36.00
Spiegeleisen, 20 per cent, furnace or duty paid	$33.00 to $35.00
Ferrosilicon, 50 per cent, delivered, per gross ton, carloads	$82.50 to $87.50
Ferrotungsten, per lb. of contained metal,	90c. to 95c.
Ferrochromium, 4 to 8 per cent carbon, 60 to 70 per cent Cr., per lb. Cr., delivered	13c. to 14c.
Ferrovanadium, per lb. of contained vanadium	$3.50 to $4.00
Ferrocarbontitanium, 15 to 18 per cent, in carloads, per net ton	$200.00
Ores	
Manganese ore, foreign, per unit, c.i.f.	29c. to 30c.
Tungsten ore, per unit, in 60 per cent concentrates, nominal	$7.50 to $8.50
Chrome ore, basis 48 per cent Cr_2O_3, crude, per ton, c.i.f. Atlantic seaboard	$18.00 to $28.00
Molybdenum ore, 85 per cent concentrates, per lb. of MoS_2, New York	55c. to 60c.

Finished Iron and Steel.—The first business day of the year was marked by purchasing of round lots of steel and was conspicuous also for the optimistic attitude of buyers and sellers, as practically all consumers appear to be unusually busy and with an outlook for several months of sustained activity. A good tonnage of fabricated steel work was put under contract, considerable railroad car business developed and some buying of round lots of plain structural material was reported. Exporters also reported prospects as satisfactory, believing the coming year will be much better than 1922.

We quote for mill shipments, New York delivery, as follows: Soft steel bars and steel plates, 2.34c.; structural shapes, 2.29c. to 2.38c.; bar iron, 2.34c.

Cast Iron Pipe.—Not much activity is noted this week, but prices are strong and with the new year a revival of both private and municipal buying is expected. We quote per net ton, f.o.b. New York, in carload lots, as follows: 6-in. and larger, $55.50; 4-in. and 5-in., $60; 3-in., $64.80, with $4 additional for Class A and gas pipe. Jobbers are active purchasers of soil pipe and the market is strong. The recent price advance in this district is holding firm. We quote discounts of both Southern and Northern makers, delivered, New York, as follows: 2 to 6-in. standard, 28 to 30¾ per cent off list; heavy, 38 to 40¾ per cent off list.

High Speed Steel.—Although the market is still quiet, one producer reports a better month in December than in November, which was a good month. With tungsten at $1 per lb. the current price of high speed steel is considered out of line by some makers. The market continues unchanged at 75c. to 80c. per lb. for 18 per cent tungsten high speed steel with special brands of some companies ranging up to 90c. per lb.

Warehouse Business.—It has been an exceedingly quiet week, but prices, with the exception of black and galvanized sheets, continue firm. Blue annealed are strong and 4.19c. per lb. base is well maintained with no shading reported. Black sheets, however, are going in a large number of instances at 4.50c. and as low as 4.35c. per lb., base, although 4.75c. per lb. is said to be still obtainable on small orders. Galvanized have declined to 5.25c. per lb., and even this quotation is reported shaded at times. One large warehouse interest in this district reports December business as exceptionally good and well maintained until the last few days of the year. Wrought iron and steel pipe are unchanged with business quiet this week. We quote prices on page 136.

Old Material.—Prices are generally tending upward and the market is strong on practically all grades. No. 1 heavy melting steel is quotable this week at $13.50 to $14 per ton, based on payment of as high as $19 per ton for shipment to Wierton and with $17.50 per ton being paid for shipment to Bethlehem Steel Co. on railroad quality, $14.50 to $15 per ton, New York, is justified. Sales of small tonnages of No. 1 yard wrought have been made to Rockaway and $13.50 to $14 per ton covers the range of prices being paid, New York. Clean cast borings are active and the price strong at $12 to $12.50 with $17 to $18 per ton a fair range for cast borings for chemical plants. In fact, one broker in this district has refused $22 per ton from one chemical plant within a $2 per ton freight rate of New York, in anticipation of a still higher market. Mixed borings and turnings are quotable at $11.25 to $11.75 with Wierton, Steubenville, Monesson and Bethlehem buying. For shipment to the latter only $12.50 per ton is being paid. Stove plate is strong at $13 to $13.50 per ton.

Buying prices per gross ton, New York, follow:

Heavy melting steel, yard	$13.50 to $14.00
Steel rails, short lengths, or equivalent	14.50 to 15.00
Rails for rolling	16.00 to 16.50
Relaying rails, nominal	21.00 to 22.00
Steel car axles	17.00 to 18.00
Iron car axles	25.00 to 26.00
No. 1 railroad wrought	15.00 to 15.50
Wrought iron track	14.00 to 14.50
Forge fire	11.00 to 11.50
No. 1 yard wrought, long	13.50 to 14.00
Cast borings (clean)	12.00 to 12.50
Machine-shop turnings	12.00 to 12.50
Mixed borings and turnings	11.25 to 11.75
Iron and steel pipe (1 in. diam., not under 2 ft. long)	10.50 to 11.00
Stove plate	13.00 to 13.50
Locomotive grate bars	13.00 to 13.50
Malleable cast (railroad)	13.50 to 14.00
Cast-iron car wheels	16.50 to 17.50

Prices which dealers in New York and Brooklyn are quoting to local foundries per gross ton follow:

No. 1 machinery cast	$19.00 to $20.00
No. 1 heavy cast (columns, building materials, etc.), cupola size	17.00 to 17.50
No. 1 heavy cast, not cupola size	15.00 to 15.50
No. 2 cast (radiators, cast boilers, etc.)	13.50 to 14.00

Buffalo

Production Problem Now Faced—Inquiry for 5000 Tons of Malleable

BUFFALO, Jan. 2.—The close of 1922 found the market in a condition where the problem really concerns the production of sufficient pig iron to meet orders now on the books rather than a selling problem. Recent business has been from small users seeking to cover. The run of tonnages is from carloads to 250 tons. An inquiry for 5000 tons of malleable received by a producer was disregarded because the furnace could not promise delivery. While sellers having satisfactory backlogs are asking $27 for silicon 1.75 to 2.25 there is still iron available at $26 base.

We quote f.o.b. per gross ton Buffalo as follows, the higher price being for early shipment:

No. 1 foundry, 2.75 to 3.25 sil.	$27.00
No. 2X foundry, 2.25 to 2.75 sil.	26.50
No. 2 plain, 1.75 to 2.25 sil.	26.00
Basic	25.25
Malleable	26.00
Lake Superior charcoal	33.28

Finished Iron and Steel.—Demand for certain products such as bars, pipe and wire was brisker this year at holiday time than in many years. Weaker bar prices continue; 1.90c. is understood to have been slightly shaded on a transaction of 700 tons for a Buffalo con-

sumer. Pipe specifications, usually quiet at this time, have been especially heavy. Sheet prices which have been firm at 3.35c. and 4.35c. may be advanced if demand increases.

We quote warehouse prices, Buffalo, as follows: Structural shapes, 3.20c.; plates, 3.20c.; soft steel bars, 3.10c.; hoops, 4.10c.; bands, 3.90c.; blue annealed sheets, No. 10 gage, 4.05c.; galvanized steel sheets, No. 28 gage, 5.85c.; black sheets, No. 28, 4.85c.; cold rolled round shafting, 3.95c.

Old Material.—Only a few scattered sales have been made; dealers are not anxious to touch these transactions, generally figuring on better prices after the month is under way. Sales of heavy melting steel have not in any single instance involved more than 200 tons since the holiday season started. There is every indication of a lively market this month.

We quote dealers' asking prices per gross ton f.o.b. Buffalo as follows:

Heavy melting steel	$19.00 to $19.50
Low phos., 0.04 and under	21.00 to 22.00
No. 1 railroad wrought	18.00 to 19.00
Car wheels	21.00 to 22.00
Machine-shop turnings	14.50 to 15.50
Cast iron borings	16.25 to 16.75
Heavy axle turnings	17.50 to 18.50
Grate bars	16.00 to 17.00
No. 1 busheling	16.50 to 17.50
Stove plate	17.00 to 18.00
Bundled sheet stampings	14.00 to 15.00
No. 1 machinery cast	20.00 to 21.00
Hydraulic compressed	17.00 to 17.50
Railroad malleable	20.50 to 21.50

Cleveland

Pig Iron Prices Firm—Inquiry for Basic Pending—Coke Scarce

CLEVELAND, Jan. 2.—While the pig iron market is quiet as compared with the few previous weeks, Cleveland producers report sales aggregating 12,000 tons, mostly in foundry grades during the week, the activity being largely confined to western Pennsylvania furnaces. Sales include 2000 tons of gray forge iron in the Pittsburgh district at $25, but the buying was for the most part in small lots. Prices are very firm. The only change in the price situation is an advance of 50c. a ton to $27 in the Cleveland price on foundry iron for out-of-town shipments, making the local price $27 for both Cleveland and outside delivery. In Detroit and Toledo the price is unchanged at $28. A Canton, Ohio, consumer came in the market during the week for 5000 to 10,000 tons of basic iron. This business is reported to have been placed, although it did not go to a Cleveland producer. On this inquiry a Cleveland interest quoted $27 and it is claimed that with stiffening prices due partly to the advance in coke, little basic iron can now be bought at a lower price. As far as known here, the Central Steel Co., Massillon, Ohio, has not yet purchased the 45,000 tons of basic iron it recently inquired for.

Quotations below, except on basic and low phosphorus iron, are delivered Cleveland, and for local iron includes a 50c. switching charge. Ohio silvery and Southern iron prices are based on a $3.02 freight rate from Jackson and a $6 rate from Birmingham.

Basic, Valley furnace (nominal)	$25.00 to $26.00
Northern No. 2 fdy., sil. 1.75 to 2.25	27.50
Southern fdy., sil. 1.75 to 2.25	29.00
Malleable	27.50
Ohio silvery, nominal, sil. 8 per cent	38.52
Standard low phos., Valley furnace	76.00

Iron Ore.—Shipments from docks are rather light. Consumers have good supplies in their furnace yards, and in view of the rather severe weather conditions, are not sending in many shipping orders.

We quote delivered lower lake ports: Old range Bessemer, 55 per cent iron, $5.95; Old range non-Bessemer, 51½ per cent iron, $5.20; Mesabi Bessemer, 55 per cent iron, $5.70; Mesabi non-Bessemer, 51½ per cent iron, $5.05.

Semi-Finished Steel.—The market is firm and fairly active. A local producer during the week sold 12,000 to 15,000 tons of semi-finished steel, mostly in sheet bars, including a 6000-ton lot to a central Ohio consumer at $38.50, Youngstown. Cleveland sales included 1000 tons of slabs to a Chicago consumer at the same price.

Finished Material.—There was somewhat of a lull in the market during the holiday week, but not so pronounced as in some years. Mills are getting a good volume of small orders. Buyers seem to feel that present prices will hold and some are buying a little more freely than they would were they expecting lower prices. Steel bars and plates and structural material seem firmly established at 2c. and it is doubtful whether an attractive tonnage would bring out a lower price. The McKinney Steel Co. has asked for bids for rebuilding two blast furnaces in Cleveland requiring 3000 tons of plates. Stoves now used will not be replaced. The advance in price on rerolling rails has tended to stiffen hard steel reinforcing bars and mills are no longer inclined to sell these below 2c.

Jobbers quote steel bars, 2.91c.; plates and structural shapes, 3.01c.; No. 9 galvanized wire, 3.30c.; No. 9 annealed wire, 2.80c.; No. 28 black sheets, 4.35c. to 4.40c.; No. 28 galvanized sheets, 5c. to 5.40c.; No. 10 blue annealed sheets, 3.70c. to 3.76c.; hoops and bands, 3.71c.; cold-rolled rounds, 3.75c.; flats, squares and hexagons, 4.25c.

Sheets.—The more common prices on sheets are 3.35c. for black and 4.35c. for galvanized, in spite of efforts of some independent mills to get $3 a ton above these prices. On blue annealed sheets, quotations range from 2.50c. to 2.60c.

Bolts and Nuts.—Makers are getting good specifications on contracts and considerable first quarter business was booked during the week at regular prices.

Coke.—The supply of foundry coke is very scarce and prices have further advanced. The last sales reported were at $9.50 for standard Connellsville and $9 for Wise County foundry coke.

Old Material.—The scrap market has become fairly active and firm. Heavy melting steel has advanced 75c. a ton in Cleveland and 50c. in Youngstown, and several other grades are about 50c. higher. Valley district mills are reported to have bought considerable scrap during the week, sales being reported at $21.50 for heavy melting steel and $19.50 for compressed steel. The same prices are being paid by some dealers. Two local companies purchased odd lots of heavy melting steel at $20 delivered. Mills are crowding dealers for deliveries on contracts. The supply of scrap is by no means plentiful.

We quote per gross ton, f.o.b. Cleveland, as follows:

Heavy melting steel	$19.25 to $19.75
Rerolling rails under 3 ft.	20.75 to 21.25
Steel rails for rolling	22.00 to 22.50
Iron rails	18.00 to 18.50
Iron car axles	25.00 to 26.00
Low phosphorus melting	21.25 to 21.50
Cast borings	17.00 to 17.50
Machine shop turnings	15.25 to 15.50
Mixed borings and short turnings	16.50 to 17.00
Compressed steel	17.00 to 17.50
Railroad wrought	17.50 to 18.00
Railroad malleable	20.00 to 20.50
Light bundled sheet stampings	13.75 to 14.25
Steel axle turnings	17.00 to 17.50
No. 1 cast	20.50 to 21.00
No. 1 busheling	15.00 to 15.50
Drop forge flashings over 10 in.	13.00 to 13.50
Drop forge flashings under 10 in.	13.50 to 14.00
Railroad grate bars	17.00 to 17.50
Stove plate	17.00 to 17.50
Pipes and flues	13.00 to 13.75

Birmingham

Pig Iron Market Fairly Firm at $23—Total Bookings Large

BIRMINGHAM, Ala., Jan. 2.—The year entered with Birmingham iron fairly firm at $23 for any large tonnage and $24 to $25 for small lots, these prices being actually gotten. It is estimated that total bookings of Alabama furnace interests into 1923 will approximate 450,000 to 500,000 tons, of which probably 50,000 tons is for second half delivery to large pipe makers. Total Alabama production is about 220,000 tons a month, of which 150,000 tons are foundry. At present capacity, the first quarter production will be 450,000 tons of merchant iron, to which may be added 60,000 tons on yards. However, the Tennessee company blew in a fourth stack on foundry this week and the Woodward Iron Co. blew in a large Woodward stack. A small Vanderbilt stack went out for relining work of about three weeks. The Alabama Co. announces blowing in a second stack at Gadsden, Feb. 1. Alabama seems headed to another high iron-producing record.

Large business has been done in the Middle West, a Chicago melter taking 2000 ton sat $23 and Cincinnati melters taking 500 and 1000-ton lots at the same base. All makers feel easy with books well-covered for first quarter and stocks on yards also cared for. Freight service is very good.

We quote per gross ton f.o.b. Birmingham district furnaces as follows:

Foundry, silicon 1.75 to 2.25	$23.00
Basic	23.00
Charcoal, warm blast	32.00

Finishing Mills.—The Tennessee company, the Gulf States Steel Co. and the American Steel & Wire Co. started the new year promptly and, where possible, with larger producing capacity active. The same is true of the hoop and band mills of the Conners Steel Co. and fabricating steel works. Car plants and rail mills have orders calling for full operations for six months. Galvanized sheets are in strong demand and all wire mill products are active.

Cast Iron Pipe.—Following an avalanche of orders by jobbers, soil pipe makers advanced the base from $50 to $55 and then to $60, after which, first quarter being largely cared for, they retired from the market. Another advance is expected soon. Pressure pipe remains at $42 and $43. The United States Cast Iron Pipe & Foundry Co. booked 2000 tons for Cleveland and Hammond-Byrd Iron Co., 600 tons for Akron.

Coal and Coke.—Walter Moore, president Empire Coal Co., announces plans for immediate construction of a by-product plant to cost $2,000,000 at company mines in Walker county. Coke is firm at $7.50 to $8 with $8.50 obtained for spot delivery.

Old Material.—The scrap market is looking up and the quoted prices are obtained. Steel is firmer and tends to advance.

We quote per gross ton f.o.b. Birmingham district yards as follows:

Steel rails	$16.00 to $17.00
No. 1 steel	14.00 to 16.00
No. 1 cast	18.00 to 20.00
Car wheels	18.00 to 20.00
Tramcar wheels	17.00 to 19.00
Stove plate	16.00 to 17.00
Cast-iron borings	9.00 to 10.00
Machine shop turnings	9.00 to 10.00

Philadelphia

Year Opens with Markets All Firmer—Prices of Pig Iron and Scrap Advance

PHILADELPHIA, Jan. 2.—Seldom has the iron and steel industry entered upon a new year in a better position as to tonnage on its books and as to the outlook for the first quarter of the year. The volume of business that was closed in the last two weeks of December both in finished steel and pig iron was as welcome as it was surprising, for it placed producers in a stronger attitude than they have been able to assume since 1920. Price advances have been announced by at least two independent makers of wire products; an Eastern steel company has followed the lead of a Youngstown company in advancing sheets $3 a ton; bars and shapes have become firm at 2c., Pittsburgh, while even a degree of strength has been noted in plates, which have been lagging behind other steel products. The volume of plate business booked in the past week has caused some mills to announce their minimum as 2c., and while desirable lots could still be bought at 1.90c. and 1.95c., there is a firmer undertone to the market. Not less than 100,000 tons of pig iron was placed with eastern Pennsylvania and New Jersey furnaces in the last two weeks of the old year. The scrap market is strong and No. 1 heavy melting steel has advanced to $18 on purchases by a steel company of 10,000 tons or more.

Pig Iron.—An Eastern steel company has closed for 22,000 tons of basic pig iron for February-March delivery at prices ranging from $26.50 to $26.75, delivered. The orders were given to four or five furnaces. A few thousand tons of basic is wanted by a New England wire company. Including the basic business and the 27,000 tons of foundry iron bought by a cast iron pipe company, as reported last week, sales of pig iron by eastern Pennsylvania and New Jersey furnaces in the last two weeks of December totaled not less than 100,000 tons. There were also fair sales of foreign iron. All of the makers in this district have advanced prices of foundry iron $1 a ton, now quoting No. 2 plain at $28, No. 2 X at $29 and No. 1 X at $30, furnace. On a large tonnage there is still a possibility that these prices might be shaded, but the tendency is toward increasing firmness and the new prices have been established by sales for first quarter. Most of the large business has been disposed of, but there is a considerable volume of orders ranging from 100 to 300 tons. Alabama iron has been sold at Baltimore at less than $23, Birmingham. Receipts of foreign iron in the week ended Dec. 30 were 5397 tons as follows: German, 1000 tons; France, 2597; Scotland, 1800. More foreign iron is being negotiated for by American iron merchants. Prices in England have advanced slightly, due to higher rate of exchange. An Eastern consumer has bought a few thousand tons of gray forge at about $27.75, delivered.

The following quotations are, with the exception of those on low phosphorus iron, for delivery at Philadelphia and include freight rates varying from 76 cents to $1.64 per gross ton:

East. Pa. No. 2 plain, 1.75 to 2.25 sil.	$28.76 to $29.14
East. Pa. No. 2X, 2.25 to 2.75 sil.	29.76 to 30.14
East. Pa. No. 1X	30.76 to 31.14
Virginia No. 2 plain, 1.75 to 2.25 sil.	32.17 to 33.17
Virginia No. 2X, 2.25 to 2.75 sil.	33.17 to 34.17
Basic delivered eastern Pa.	26.50 to 26.75
Gray forge	27.75 to 28.00
Malleable	29.64 to 30.60
Standard low phos. (f.o.b. furnace)	35.00
Copper bearing low phos. (f.o.b. furnace)	30.00

Ore.—It is estimated that at least 500,000 tons of foreign ore has come into the United States during the past year exclusive of that which the Bethlehem Steel Co. brings from its own mines in Chile and Cuba. As ore piles at Eastern furnaces are being reduced, the prospects are that a larger movement of foreign ore will develop within the next few months. Last week's receipts at this port were 7000 tons of iron ore from Tunis, 4300 tons of chrome ore from South Africa and 500 tons of chrome ore from British India.

Semi-Finished Steel.—Notwithstanding firmness in finished steel, prices of semi-finished are slightly easier. It is possible to buy open hearth or Bessemer rerolling billets at $36.50, Pittsburgh. Forging billets are unchanged at $42.50, Pittsburgh.

Plates.—Some of the Eastern plate mills are now quoting 2c., Pittsburgh, and announce that they will not entertain business at any lower figure. It appears, however, that it is still possible to buy in large lots for immediate specification at 1.90c. and 1.95c., but contracts are not being made at less than 2c. The Pennsylvania Railroad has inquired for 2000 to 5000 tons for first half, but mills are disinclined to quote further ahead than first quarter. The Philadelphia & Reading is in the market for 1500 tons. The Norfolk & Western last week closed for several hundred tons of plates and a shipbuilder has bought 600 tons. New orders for cars from the Baltimore & Ohio and Great Northern will require close to 75,000 tons of steel. The Baldwin Locomotive Works is reported to have six months' work ahead and has just closed contracts with the Chicago, Burlington & Quincy for 60 large engines and with the Atchison, Topeko & Santa Fe for 18.

Structural Steel.—Shapes are now firm at 2c., Pittsburgh. Mills have a substantial quantity of business on their books and it appears that whatever weakness existed in the market in the latter half of December has entirely disappeared.

Bars.—Large orders for bars were received in the last two weeks of the old year and mills are now firmly intrenched and disinclined to consider any business at less than 2c., Pittsburgh. The General Motors Corporation is about to close for 150,000 tons of bars and other steel products for first quarter. An Eastern subsidiary of General Motors was in the market for 4000 tons of bars, but this lot will probably be included in the specifications of the parent company. The Norfolk & Western last week bought about 2000 tons of bars

and bar-size angles. Bar iron is now firm at 2c., Pittsburgh, and orders are increasing in numbers.

Sheets.—The Bethlehem Steel Co. has followed the Brier Hill Steel Co. in advancing prices of sheets $3 a ton. The minimum for blue annealed now is 2.60c., Pittsburgh, with some companies, while others are not inclined to quote 2.50c. except on exceptionally attractive orders. Some of the Ohio sheet mills are well sold up for first quarter and have virtually withdrawn from the market.

Wire Products.—The Cambria Steel Co. has followed the Pittsburgh Steel Co. in advancing prices of wire products, now naming 2.80c. per lb. on wire nails; 2.60c. on plain wire; 2.35c. for coated nails; 3.10c. for painted barbed wire and 3.45c. for galvanized barbed wire; 3.10c. for polished staples and galvanized wire of No. 14 gage and heavier.

Old Material.—There was heavy buying of No. 1 heavy melting steel by an Eastern mill last week at $18, delivered, 10,000 tons or more having been taken at this price. Other grades of scrap have also gone up on lesser transactions. A scarcity of several grades of scrap exists and higher prices are expected when demand develops larger volume.

We quote for delivery at consuming points in this district as follows:

No. 1 heavy melting steel	$18.00 to $18.50
Scrap rails	18.00 to 18.50
Steel rails for rolling	19.50 to 20.00
No. 1 low phos., heavy 0.04 and under	22.00 to 23.00
Cast iron car wheels	20.00 to 21.00
No. 1 railroad wrought	20.00 to 21.00
No. 1 yard wrought	18.00 to 19.00
No. 1 forge fire	16.50 to 17.50
Bundled sheets (for steel works)	15.50 to 16.00
No. 1 busheling	15.50 to 16.00
Turnings (short shoveling-grade for blast furnace use)	15.00 to 15.50
Mixed borings and turnings (for blast furnace use)	14.50 to 15.00
Machine shop turnings (for steel works use)	15.50 to 16.00
Machine shop turnings (for rolling mill use)	15.50 to 16.00
Heavy axle turnings (or equivalent)	16.50 to 17.00
Cast borings (for steel works and rolling mills)	15.50 to 16.00
Cast borings (for chemical plants)	20.00 to 22.00
No. 1 cast	22.00 to 23.00
Heavy breakable cast (for steel plants)	19.50 to 20.00
Railroad grate bars	16.50 to 17.00
Stove plate (for steel plant use)	16.50 to 17.00
Railroad malleable	15.50 to 16.50
Wrought iron and soft steel pipes and tubes (new specifications)	15.50 to 16.50
Shafting	21.00 to 22.00
Steel axles	22.00

St. Louis

Round Tonnage of Pig Iron Only Noteworthy Sale in a Quiet Week

ST. LOUIS, Jan. 2.—The principal sale of the week was made by the St. Louis Coke & Chemical Co. of between 6000 and 10,000 tons of foundry iron to an East Side melter. Outside of that there was little activity, the holidays and the approach of the time for inventory taking causing the usual lull in buying experience at this time of year. The local melter's sale reported above was for first quarter delivery, books for which have been closed. The market for Northern iron is firm at $28, Chicago, on the expectation that heavy purchases will be made shortly after the new year opens. Locally there has been very little buying for next year, although melters have had a big year and their stocks are low. Many melters in other parts of the district have been delaying buying, and considerable activity is looked for by men in the trade. The market for Southern iron is strong at $23, Birmingham, with several concerns still quoting $25.

We quote delivered consumers' yards, St. Louis, as follows, having added to furnace prices $2.16 freight from Chicago, $3.28 from Birmingham (rail and water), $5.17 from Birmingham, all rail, and 81 cents average switching charge from Granite City:

Northern foundry, sil. 1.75 to 2.25	$30.16
Northern malleable, sil. 1.75 to 2.25	30.16
Basic	30.16
Southern foundry, 1.75 to 2.25	28.17

Old Material.—The new year opens with a strong sentiment in the market for old material with prices higher on most items. There has been no buying in the last two weeks to speak of, but the indications are that consumers will come into the market strong just as soon as the inventory period is over. Stocks in hands of consumers are low and consumption has been heavy. Another strong factor is that Kansas City, Peoria and other markets have become active, buying material that ordinarily would come to St. Louis. The only railroad list has been issued by the Wabash, covering 1000 tons of rails for rerolling and 1000 tons of miscellaneous rails.

We quote dealers' prices f.o.b. consumers' works, St. Louis industrial district and dealers' yards, as follows:

Per Gross Ton	
Iron rails	$20.00 to $20.50
Rails for rolling	17.50 to 18.00
Steel rails, less than 3 ft	19.50 to 20.00
Relaying rails, standard section	26.00 to 29.00
Cast iron car wheels	24.50 to 25.00
Heavy melting steel	16.50 to 17.00
Heavy shoveling steel	16.00 to 16.50
Frogs, switches and guards cut apart	16.50 to 17.00
Per Net Ton	
Heavy axles and tire turnings	12.00 to 12.50
Steel angle bars	17.00 to 17.50
Iron car axles	26.00 to 26.50
Steel car axles	19.50 to 20.00
Wrought iron bars and transoms	21.50 to 22.00
No. 1 railroad wrought	16.00 to 16.50
No. 2 railroad wrought	15.50 to 16.00
Railroad springs	20.50 to 21.00
Steel couplers and knuckles	20.50 to 21.00
Cast iron borings	11.00 to 11.50
No. 1 busheling	13.50 to 14.00
No. 1 railroad cast	19.00 to 19.50
No. 1 machinery cast	20.00 to 20.50
Railroad malleable	18.00 to 18.50
Machine shop turnings	9.50 to 10.00

Boston

Business Quiet, But Undertone of Prices Appears Firmer

BOSTON, Jan. 2.—Comparatively little pig iron was sold in this territory the past week and prospective business is limited to a few hundred tons each of regular foundry and malleable grades. Sales included small tonnages of Alabama at $23 furnace base, Virginia at $27 base, western Pennsylvania at $25.50 and $26 base, and odds and ends of spot Scotch at prices running as high as $29.50 for silicon 2.25 to 2.75, duty paid, on dock here. The Buffalo market was practically at a standstill, but firmer, $25 iron having disappeared. Eastern Pennsylvania is nominal at $27 and $28 furnace base, little being available. Differentials on Alabama and Virginia hold to 50c., but on Buffalo and eastern Pennsylvania spread $1 in some instances. The position of spot foreign iron is strengthened by a New York, New Haven & Hartford Railroad embargo and the uncertainty of shipments from points west of New England. The shortage of New Haven's conditioned locomotives is acute. The road has just leased several from the Bangor & Aroostook Railroad.

We quote delivered prices on the basis of the latest reported sales, now infrequent, and as follows, having added to furnace prices $3.65 freight from eastern Pennsylvania, $4.91 from Buffalo, $5.92 from Virginia and $9.60 from Alabama:

Eastern Penn., sil. 2.25 to 2.75	$31.15 to $32.65
Eastern Penn., sil. 1.75 to 2.25	30.65 to 31.65
Buffalo, sil. 2.25 to 2.75	31.91 to 32.65
Buffalo, sil. 1.75 to 2.25	30.91 to 31.41
Virginia, sil. 2.25 to 2.75	33.42 to 34.42
Virginia, sil. 1.75 to 2.25	32.92 to 33.92
Alabama, sil. 2.25 to 2.75	33.10
Alabama, sil. 1.75 to 2.25	32.60

Iron Importations.—During the week ending Dec. 30, a total of 1602 tons of foreign iron was received at the port of Boston, comprising 602 tons of German, and 1000 tons of English. There were no importations the previous week. Unofficial figures show imports of 52,515 tons from July 1 to Dec. 30. Of this amount, 27,737 tons was Scotch iron, 13,300 tons English, 500 tons French, 10,376 tons Belgian, and 602 tons German.

Coke.—New England producers of by-product foundry coke have reduced their contract price $1 a ton to $15 delivered within the $3.10 local freight zone. Both interests are booked well ahead and are not accepting business through brokers except subject to confirmation. Due to the continued shortage of cars, shipments by these producers are backward. The reduction in prices presumably is due to the activity of Connellsville coke

in this territory. Estimated sales of Connellsville 48-hr. coke for the week ending Dec. 30, for both foundry and domestic purposes, run close to the 20,000 ton mark. Prices paid by coal dealers have run as high as $9.50 on cars ovens or $15.05 delivered for prompt shipment fuel, and for foundry consumption about 50c. a ton less.

Cincinnati

Pig Iron Market Firm, but Sales Few—Scrap Advances

CINCINNATI, Jan. 2.—The pig iron market was quiet during the past week and only a few sales of importance were reported. Inquiry is very light, although this week is expected to bring into the market a number of large buyers who have not yet covered for first quarter requirements. The price situation is undoubtedly much firmer, and the Southern iron, $23, base, now appears to be the absolute minimum. This price is being done on all current sales. We note one sale of Southern foundry, 500 tons, to an Indiana melter at this figure, also one of 1000 tons and another of 1500 tons for shipment to Illinois melters. Northern irons appear also to be stronger in some districts with weakness in others. For instance, a northern Indiana melter is reported to have placed an order for 1000 tons of Chicago iron at less than $28, as $27.50, Ironton, was considered too high. Southern Ohio furnaces are now generally quoting $27.50, but are not pushing sales at this price, as it is claimed that it is several dollars below actual production costs. There is little inquiry, the Louisville & Nashville Railroad being in the market for 900 tons of Southern and an Illinois car manufacturer 1000 tons of low silicon malleable. Local agents report some good sales of alloys, particularly ferromanganese and ferrosilicon at current schedules.

Based on freight rates of $4.05 from Birmingham and $2.27 from Ironton, we quote f.o.b. Cincinnati:

Southern coke, sil. 1.75 to 2.25 (base)	$27.05
Southern coke, sil. 2.25 to 2.75 (No. 2 soft)	27.55
Ohio silvery (nominal), 8 per cent	37.77
Southern Ohio coke, sil. 1.75 to 2.25 (No. 2)	29.77
Basic Northern	28.27
Malleable	29.77

Finished Material.—There is a good demand for bars, shapes and plates, although orders are for the most part confined to tonnages ranging from carload lots to 100 tons. A fair amount of contracting has been done for first quarter and some good inquiries are now being worked on. The Big Four is in the market for its plate and shape requirements for first quarter, aggregating approximately 2000 tons. It also will take bids on its requirements of wire, car axles, locomotive axles, safe ends and seamless steel. The demand for sheets is rather light, although some of the larger buyers have covered for their first quarter requirements. Prices on all products are firm, bars, shapes and plates being quoted at 2c. and blue annealed, black and galvanized sheets at 2.60c., 3.35c. and 4.35c. respectively. There is moderate activity in the structural lines, and several projects requiring considerable tonnages of reinforcing bars are now up, and others will shortly be up from this district. The general contract for the Vernon Manor Apartment Hotel, Cincinnati, for which approximately 1000 tons of bars will be required, has been let to the Ferro-Concrete Construction Co.

Coke.—There is much activity in the coke market, and while the bulk of the demand is for domestic fuel, metallurgical grades are not being neglected. Prices have advanced sharply and today Connellsville coke, either furnace or foundry, is not available under $8.50. New River foundry is quoted $11 to $12 and Wise County furnace at $8 and foundry at $8.50, this representing an advance of $1 a ton. By-product foundry is unchanged at $11, Connellsville basis.

Old Material.—Prices are strengthening in the scrap market, not on account of actual demand, but rather on prospects for good business in the future. The whole list has been marked up at least 50c. a ton by dealers, with special grades commanding still higher prices.

IRON COMPANIES WIN

Federal Trade Commission, Says Court, Not Entitled to Know About Costs

WASHINGTON, JAN. 2.—The Federal Trade Commission has no right to inquire into manufacturing costs of iron and steel. Decision to this effect was handed down today by the District Court of Appeals of the District of Columbia in the well known Claire Furnace Co. case, in which there were 21 independent iron and steel companies named as respondents. The decision confirms that of the Supreme Court of the District of Columbia and the case now will be carried to the United States Supreme Court by the Federal Trade Commission. The decision was handed down by a vote of two to one, Chief Justice Smythe dissenting. The majority opinion was written by Justice Van Orsdel and concurred in by Justice Robb.

The fundamental point involved was as to whether manufacturing is commerce, the majority holding that it is not and that, therefore, the commission has no power to make the inquiry, which had been halted by an injunction obtained in the District Supreme Court by counsel for the steel companies.

The case was begun almost two years ago and is of far reaching importance. It is held that it might set a precedent by which the Coal Fact Finding Commission could be prevented from gathering information as to costs of mining coal if operators were inclined to refuse to give such information.

The majority opinion held that the statute does not authorize the Federal Trade Commission to investigate anything but interstate commerce and that manufacturing is not commerce. Many of the questions asked of the iron and steel producers by the commission dealt with the cost of manufacturing. While the power of Congress may cover the inflow of the raw materials and the outgo of the finished products, the authority given the commission by the statute, the opinion held, does not cover this intermediate step of manufacturing. The decision distinguished between the Packer case, decided by the United States Supreme Court some time ago, and the Claire Furnace case. It was pointed out that the Department of Agriculture is given broader powers over the stockyards and the inflow and outgo of their products than is given the commission regarding commerce under the Federal Trade Commission Act.

Chief Justice Smythe in his dissent held that the answer of the Federal Trade Commission was not inextricably interwoven with interstate commerce in the iron and steel products and coal and coke involved with respect to production that the information was necessary to a complete knowledge of the commerce. In the opinion of the Chief Justice, this brought the case within the recent decision of the United States Supreme Court that the power of Congress to regulate commerce within a State existed and that it was necessary to regulate interstate commerce.

The Chief Justice also held that the obtaining of information was not regulation and that the authority of the Government to obtain the information therefore was not confined to the commerce clause of the United States constitution.

Bituminous coal production in 1922, up to Dec. 23, is placed by the United States Geological Survey at 397,631,000 tons, compared with 399,111,000 tons in 1921 and 543,199,000 tons in 1920, both at corresponding dates. Production for the same period in 1919 was 446,650,000 tons; in 1918, 571,530,000 tons; in 1917, 530,535,000 tons. Thus the past year, while practically equal to 1921, shows a deficiency of 25 to 30 per cent when compared with 1917, 1918 and 1920.

Prices Finished Iron and Steel, f.o.b. Pittsburgh

Plates

Sheared, tank quality, base, per lb.....1.95c to 2c.

Structural Material

Beams, channels, etc.....2.00c.

Iron and Steel Bars

Soft steel bars, base, per lb.....2.00c.
Refined iron bars, base, per lb.....2.60c.

Hot-Rolled Flats

Hoops, base, per lb.....2.75c. to 2.90c.
Bands, base, per lb.....2.75c. to 2.90c.
Strips, base, per lb.....275c. to 2.90c.

Cold-Finished Steels

Bars and shafting, base, per lb.....2.50c.
Strips, base, per lb.....4.50c.

Wire Products

Nails, base, per keg.....$2.70 to $2.80
Bright plain wire, base, per 100 lb..... 2.45 to 2.60
Annealed fence wire, base, per 100 lb..... 2.45 to 2.55
Spring wire, base, per 100 lb..... 3.25 to 3.50
Galvanized wire, base, per 100 lb..... 2.95 to 3.05
Galvanized barbed, base, per 100 lb..... 3.35 to 3.45
Galvanized staples, base, per keg..... 3.35 to 3.45
Painted barbed wire, base, per 100 lb..... 3.00 to 3.10
Polished staples, base, per keg..... 3.00 to 3.10
Cement coated nails, base, per count keg..... 2.20 to 2.30
Woven fence, carloads (to jobbers).....70½ per cent off list
Woven fence, carloads (to retailers).....68 per cent off list

Bolts and Nuts

Machine bolts, small, rolled threads..60 and 5 per cent off list
Machine bolts, small, cut threads...50 and 10 per cent off list
Machine bolts, larger and longer....50 and 10 per cent off list
Carriage bolts, ⅜ x 6 in.:
Smaller and shorter, rolled threads, 50, 10 and 5 per cent off list
Cut threads .....50 per cent off list
Longer and larger sizes.....50 per cent off list
Lag bolts .....60 and 5 per cent off list
Plow bolts, Nos. 1, 2 and 3 heads...50 and 10 per cent off list
Other style heads.....20 per cent extra
Machine bolts, c.p.c. and t. nuts, ⅜ x 4 in.:
Smaller and shorter.....45 per cent off list
Larger and longer sizes.....45 per cent off list
Hot pressed square or hex. blank nuts...$3.25 to $3.50 off list
Hot pressed nuts, tapped..... 3.25 to 3.50 off list
C.p.c. and t. sq. or hex. nuts, blank..... 325 to 3.50 off list
C.p.c. and t. sq. or hex. nuts, tapped..... 3.25 to 3.50 off list
Semi-finished hex. nuts:
9/16 in. and smaller, U. S. S...75, 10 and 5 per cent off list
⅝ in. and larger, U. S. S....70, 10 and 2½ per cent off list
Small sizes, S. A. E.....80 and 5 per cent off list
S. A. E., ⅝ in. and larger.....75 and 5 per cent off list
Stove bolts in packages.....80 and 5 per cent off list
Stove bolts in bulk.....80, 5 and 2½ per cent off list
Tire bolts .....50, 10 and 10 per cent off list

Cap and Set Screws

Milled square and hex. head cap screws....75 per cent off list
Milled set screws.....75 per cent off list
Upset cap screws.....75 and 10 per cent off list
Upset set screws.....80 per cent off list

Rivets

Large structural and ship rivets base, per 100 lb.....$3.00
Large boiler rivets, base, per 100 lb..... 3.10
Small rivets .....65 and 10 to 65 and 5 per cent off list

Track Equipment

Spikes, 9/16 in. and larger, base, per 100 lb..... $2.75
Spikes, ½ in. and smaller, base, per 100 lb..... 3.50
Spikes boat and barge, base, per 100 lb..... 3.50
Track bolts, base, per 100 lb.....$3.75 to 4.50
Tie plates, per 100 lb..... 2.35 to 2.50
Angle bars, base, per 100 lb..... 2.75

Welded Pipe

Butt Weld

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
⅛	49	23½	¼ to ⅜.....	+7	+33
¼ to ⅜.....	55	29½	½	26	8
½	60	46½	⅝	32	17
¾	64	52½	1 to 1½.....	34	19
1 to 3.....	66	54½			

Lap Weld

2	59	47½	2	29	15
2½ to 6.....	63	51½	2½ to 6.....	32½	19
7 to 8.....	60	47½	7 to 12.....	30	17
9 to 12.....	59	46½			

Butt Weld, extra strong, plain ends

⅛	45	28½	¼ to ⅜.....+15		+48
¼ to ⅜.....	51	34½	½	25	13
½	57	46½	¾	32	18
¾	62	51½	1 to 1½.....	34	20
1 to 1½.....	64	53½			
2 to 3.....	65	54½			

Lap Weld, extra strong, plain ends

2	57	46½	2	30	17
2½ to 4.....	61	50½	2½ to 4.....	33	21
4½ to 6.....	60	49½	4½ to 6.....	32	20
7 to 8.....	56	43½	7 to 8.....	25	13
9 to 12.....	50	37½	9 to 12.....	20	8

To the large jobbing trade the above discounts are increased by one point, with supplementary discounts of 5 and 2½ per cent.

Boiler Tubes

Lap Welded Steel		*Charcoal Iron*	
1¾ in.	21½	1½ in. .....+12	
2 to 2¼ in.....	36	1⅝ to 1⅞ in.....+ 2	
2½ to 3 in.....	47	2 to 2¼ in.....— 8	
3¼ to 13 in.....	52	2½ to 3 in.....—13	
		3¼ to 4½ in.....—15	

To large buyers of steel tubes a supplementary discount of 5 per cent is allowed.

Standard Commercial Seamless Boiler Tubes

Discounts on cold-drawn tubes in carload lots, f.o.b. Pittsburgh, follow:

1 in.	55	2½ and 2¾ in.....	38
1¼ and 1½ in.....	47	3 in.	42
1¾ in.	31	3¼ to 4 in.....	47
2 and 2¼ in.....	34	4¼ in. and 5 in.....	39

Hot Rolled

3 in.	44	3¼ to 4 in.....	49

Less carloads 4 points less. Add $8 per net ton for more than four gages heavier than standard. No extras for lengths up to and including 24 ft. Sizes smaller than 1 in. and lighter than standard gage to be sold at mechanical tube list and discount. Intermediate sizes and gages not listed take price of next larger outside diameter and heavier gage.

Seamless Mechanical Tubing

Carbon under 0.30, base.....85 per cent off list
Carbon 0.30 to 0.40, base.....83 per cent off list
Plus usual differentials and extras for cutting.

Seamless Locomotive and Superheater Tubes

Cents per Ft.		Cents per Ft.	
2-in. O.D. 12 gage.....	14	2¼-in. O.D. 10 gage....	19
2-in. O.D. 11 gage.....	15	3-in. O.D. 7 gage.....	34
2-in. O.D. 10 gage.....	16	1½-in. O.D. 9 gage.....	13¾
2¼-in. O.D. 12 gage....	16	5¾-in. O.D. 9 gage.....	53
2¼-in. O.D. 11 gage....	17	5½-in. O.D. 9 gage.....	55

Tin Plate

Standard cokes, per base box.....$4.75

Terne Plate

(Per package, 200-lb.)

8-lb. coating $9.30		25-lb. coating I. C....$14.25	
8-lb. coating I. C..... 9.60		30-lb. coating I. C.... 15.25	
15-lb. coating I. C.....11.80		35-lb. coating I. C.... 16.25	
20-lb. coating I. C.....13.00		40-lb. coating I. C.... 17.25	

Sheets

Blue Annealed

Nos. 9 and 10 (base), per lb.....2.50c.

Box Annealed, One Pass Cold Rolled

No. 28 (base), per lb.....3.35c.
Regular auto body sheets, base (22 gage), per lb., 4.70c. to 5.00c.

Galvanized

No. 28 (base), per lb.....4.35c.

Tin-Mill Black Plate

No. 28 (base), per lb.....3.35c.

Manufacturers have pamphlets, which can be had upon application, giving price differentials for gage and extras for length, width, shearing, etc.

Freight Rates

All rail freight rates from Pittsburgh on finished iron and steel products, in carload lots, to points named, per 100 lb., are as follows:

Philadelphia, domestic	$0.325	Buffalo	$0.265	St. Louis	$0.43
Philadelphia, export	0.235	Cleveland	0.215	Kansas City	0.735
Baltimore, domestic	0.315	Cleveland, Youngstown		Kansas City (pipe)	0.705
Baltimore, export	0.225	Comb.	0.19	St. Paul	0.60
New York, domestic	0.34	Detroit	0.29	Omaha	0.735
New York, export	0.255	Cincinnati	0.29	Omaha (pipe)	0.705
Boston, domestic	0.365	Indianapolis	0.31	Denver	1.27
Boston, export	0.255	Chicago	0.34	Denver (pipe)	1.215

Pacific Coast	$1.50		
Pac. Coast, ship plates	1.20		
Birmingham	0.69		
Memphis	0.385		
Jacksonville, all rail	0.50		
Jacksonville, rail and water	0.415		
New Orleans	0.515		

The minimum carload to most of the foregoing points is 36,000 lb. To Denver the minimum loading is 40,000 lb., while to the Pacific Coast on all iron and steel products, except structural material, the minimum is 80,000 lb. On the latter item the rate applies to a minimum of 50,000 lb., and there is an extra charge of 9c. per 100 lb. on carloads of a minimum of 40,000 lb. On shipments of wrought iron and steel pipe to Kansas City, St. Paul, Omaha and Denver the minimum carload is 46,000 lb. On iron and steel items not noted above the rates vary somewhat and are given in detail in the regular railroad tariffs.

Rates from Atlantic Coast ports (i.e., New York, Philadelphia and Baltimore) to Pacific Coast ports of call on most steamship lines, via the Panama Canal, are as follows: Pig iron, 30c. to 40c.; ship plates, 30c. to 40c.; ingot and muck bars, structural steel, common wire products, including cut or wire nails, spikes and wire hoops, 30c. to 40c.; sheets and tin plates, 50c.; rods, wire rope cable and strands, 75c.; wire fencing, netting and stretcher, 50c.; pipe not over 8 in. in diameter, 50c.; over 8 in. in diameter, 2½c. per in. or fraction thereof additional. All prices per 100 lb. in carload lots, minimum 40,000 lb.

NON-FERROUS METALS

The Week's Prices

Cents Per Pound for Early Delivery

	Copper, New York		Straits Tin	Lead		Zinc	
Dec.	Lake	Electrolytic*	New York	New York	St. Louis	New York	St. Louis
27	14.75	14.50	38.87½	7.30	7.00	7.30	6.95
28	14.75	14.50	38.75	7.30	7.05	7.35	7.00
29	14.75	14.50	38.75	7.30	7.05	7.35	7.00
30	14.75	14.50	....	7.25	7.05	7.40	7.05
Jan. 2	14.75	14.50	39.00	7.25	7.10	7.40	7.05

*Refinery quotation; delivered price is 14.75c.

New York

NEW YORK, Jan. 2.

The holidays have interfered somewhat with the activities of the markets, but as the year commences prices in all the markets are firm and the prospects for good business are excellent.

Copper.—The sharp advance in electrolytic copper in the last weeks of the old year to the highest prices since 1920 have been maintained as the new year opens and moderately large sales have already been made at 14.75c., delivered. There are also substantial inquiries before the market from both domestic and foreign consumers. While here and there small quantities can possibly be obtained at 14.62½c., delivered, the general market is firm at ⅛c. higher, with prospects of higher prices later. Predictions of a 15c. market by this time have not been realized. Lake copper is quoted at 14.75c. to 15c., delivered.

Copper Averages.—The average price of Lake copper for the month of December, based on daily quotations in THE IRON AGE, was 14.39½c. The average price of electrolytic copper was 14.08c., refinery, or 14.33c., delivered.

Tin.—The Straits tin market, due to the holidays here, and particularly in London, has been quiet. Total sales up to last Saturday are estimated to have been about 600 tons, the sales on certain days alternating with dull and almost stagnant markets on the other days. On Thursday, Dec. 28, March delivery was sold at 38.75c. At the end of last week there was a fair amount of inquiry, but sellers were scarce. Spot Straits tin is quoted today at 39c., New York. The London market today was about £2 per ton higher than two weeks ago, with spot standard quoted at £182 5s., future standard at £183 15s. and spot Straits at £183 15s. Deliveries into consumption for the month of December were 4875 tons, with 3704 tons in stock and landing on Dec. 31. Arrivals for the month of December were 5875 tons. Imports for the year were 59,468 tons, as compared with 24,758 tons in 1921.

Lead.—The market begins the year very quiet but exceedingly firm, particularly at St. Louis. The leading interest continues to quote January lead at 7c., St. Louis, or 7.25c., New York. In the outside market prices are considerably higher at St. Louis, sales having been made on a basis of 7.10c. for January. In New York, however, independent sellers are competing for business with the leading interest at 7.25c. Specifications on contract continue heavy and consumption of the metal is equal to that of any time during the year.

Zinc.—Late last week considerable inquiry appeared with some buying by domestic consumers of prime Western metal. As the result, the market which for several weeks had remained fairly steady at 6.95c., St. Louis, commenced to advance until today zinc for January delivery is quoted and has sold at 7.05c., St. Louis, or 7.40c., New York, for domestic consumption. Sales have also been made for foreign shipment on a basis of 7.20c., St. Louis. Statistically the market is in excellent condition with stocks very much reduced from those existing at the beginning of 1922.

Antimony.—Wholesale lots of Chinese metal for early delivery are quoted unchanged at 6.25c. to 6.35c., New York, duty paid, in a quiet but steady market, due largely to lack of free offerings from Chinese sources.

Aluminum.—Virgin metal, 98 to 99 per cent pure, in wholesale lots for early delivery from foreign producers, is quoted by importers at around 23c. per lb., New York, duty paid. There is difficulty in some cases in obtaining quotations from foreign producers and a rumor is current that the leading American producer has bought the 1923 output of some foreign refiners of aluminum. The market price of the leading American producer is not made public.

Old Metals.—The market is firm though business has slowed down over the holidays. Dealers' selling prices are as follows:

	Cents Per Lb.
Copper, heavy and crucible	14.25
Copper, heavy and wire	13.25
Copper, light and bottoms	11.75
Heavy machine composition	11.00
Brass, heavy	8.75
Brass, light	7.25
No. 1 red brass or composition turnings	10.50
No. 1 yellow rod brass turnings	8.25
Lead, heavy	6.25
Lead, tea	5.00
Zinc	5.00

Chicago

JAN. 2.—All of the metals were quiet between the holidays and prices are unchanged except for a slight advance in zinc. There have been numerous unsuccessful attempts to purchase this metal under the market price and a number of sales covering special brands or calling for special deliveries were made at considerably over the market. Copper is very firm, but is not yet quotably higher. Old metal prices are unchanged. We quote, in carload lots, lake copper, 15c.; tin, 39.50c. to 40c.; lead, 7.15c.; spelter, 7.05c.; antimony, 8.50c., in less than carload lots. On old metals we quote copper wire, crucible shapes and copper clips, 12.25c.; copper bottoms, 10.25c.; red brass, 9.25c.; yellow brass, 7.25c.; lead pipe, 5.75c.; zinc, 4.75c.; pewter, No. 1, 23c.; tin foil, 27c.; block tin, 32c., all buying prices for less than carload lots.

St. Louis

JAN 2.—We quote, carlots: Lead, 7.10c., slab zinc, 7c. On old metals, we quote light brass, 3.50c.; heavy red brass and light copper, 7c.; heavy yellow brass, 4c.; heavy copper and copper wire, 7.50c.; zinc, 3c.; pewter, 15c.; tin foil, 20c.; tea lead, 2c.; aluminum, 9c.

Swartwout Co. Organized

The Swartwout Co., Cleveland, has been organized by D. K. Swartwout, who recently resigned the presidency of the Ohio Body & Blower Co., Cleveland, the control of which has passed to other interests. The new company has closed negotiations with the Ohio Body & Blower Co. to take over all the lines of sheet metal and other products manufactured by the latter company, except automobile bodies, and has purchased the equipment used in making these products. These lines were developed and for years were manufactured by the Ohio Blower Co. under Mr. Swartwout's management. A few years ago, the company was reorganized as the Ohio Body & Blower Co. and automobile bodies were added to the products.

The Swartwout Co. has acquired quarters in the building formerly occupied by the Cleveland Milling Machine Co., Euclid Avenue, providing 100,000 sq. ft. of floor space and also has taken over the Orrville plant of the Ohio Body & Blower Co. and will operate the two plants. The company advises that the equipment acquired, together with the Orrville plant, inventories at $650,000. The products of the Swartwout Co. will include ventilators, core ovens, enameling ovens, steam specialties, exhaust heads, steam and oil separators, steam traps and feed water heaters. The officers of the Swartwout Co. are: D. K. Swartwout, president; W. M. Pattison, president Pattison Supply Co., and D. K. Swartwout, Jr., vice-presidents, and W. E. Clement, secretary and treasurer. Mr. Clement has been secretary of the Ohio Body & Blower Co.

The Swarwout Co. will have a capital stock of $500,000 in 8 per cent preferred stock and 50,000 shares in no par common stock. The financing will also include $200,000 in 10 per cent 3-year debenture notes.

British Iron and Steel Market

Steel Prospects Brighter, Though Scrap and Fuel Are Dearer—Tin Plate Strong—Galvanized Sheets Up

(By Cable)

LONDON, ENGLAND, Dec. 29.

Iron and steel plants have remained closed over the holiday week, but the market has shown considerable activity. Home and export consumers are buying pig iron and prices are showing a firmer tendency. Additional furnaces in the Midlands are re-starting. There is a good business going forward in hematite, but prices are unchanged.

Prospects in finished steel are brighter, with a fair all-around demand, the works possessing some substantial orders on which to operate when they start up again. Scrap, semi-finished steel and fuel are dearer and steel makers are less inclined to grant concessions.

Clyde ship building during 1922 amounted to 390,036 tons (gross register).

Sales of Continental material are dislocated by erratic movements of exchange rates. Quotations from the works are varying considerably.

Tin plate is strong on good home and export buying. As to the minimum basis price, some makers are now quoting up to 20½s. ($4.76) basis, f.o.b. India and Japan are buying large quantities of light wasters.

Galvanized sheets have advanced. The works are all booked up over the first quarter and some are not quoting. Good business is being done on the old price. There is strong inquiry from India.

Fair Japanese demand is in evidence for thin and for thick specifications black sheets, even at the new prices, recently advanced.

We quote per gross ton, except where otherwise stated, f.o.b. maker's works, with American equivalent figured at $4.64 per £1, as follows:

Durham coke, delivered	£1	10s.	to £1	11s.	$6.96	to $7.19
Cleveland No. 1 foundry	4	15			22.04	
Cleveland No. 3 foundry	4	11	to 4	12½	21.11	to 21.46
Cleveland No. 4 foundry	4	5			19.72	
Cleveland No. 4 forge	4	2½			19.14	
Cleveland basic	4	0			18.56	
East Coast mixed	4	13	to 4	13½	21.58	to 21.69
Ferromanganese	15	0			69.60	
Ferromanganese*	14	0			64.96	
Rails, 60 lb. and up	7	15	to 8	0	35.96	to 37.12
Billets	7	0	to 7	5	32.48	to 33.64
Sheet and tin plate bars, Welsh	7	0	to 7	13¾	32.48	to 35.67
Tin plates, base box	1	0	to 1	0½	4.64	to 4.76
					C. per Lb.	
Ship plates	8	10	to 9	0	1.76	to 1.86
Boiler plates	11	0	to 11	10	2.28	to 2.38
Tees	9	0	to 9	10	1.86	to 1.97
Channels	8	5	to 8	15	1.71	to 1.81
Beams	8	5	to 8	15	1.71	to 1.81
Round bars, ¾ to 3 in.	9	0	to 9	10	1.86	to 1.97
Galvanized sheets, 24 g.	17	15	to 18	0	3.68	to 3.73
Black sheets, 24 gage	11	15			2.43	
Black sheets, Japanese specifications	15	5			3.16	
Steel hoops	11	0	& 11	10*	2.28	& 2.38*
Cold rolled steel strip, 20 g.	22	2½			4.58	
Cotton ties, Indian specifications	15	0			3.11	

*Export price.

Continental Prices, All F. O. B. Channel Ports, Delivery as Specified

No. 3 foundry pig iron:						
Belgium, Feb., Mar.	£4	10s.	to £4	12½s.	$20.88	to $21.46
Luxemb'g, Feb., Mar.	4	10	to 4	12½	20.88	to 21.46
France, Feb., Mar.	4	10	to 4	12½	20.88	to 21.46
Billets:						
Belgium	5	14			26.45	
France	5	14			26.45	
Luxemburg	5	14			26.45	
Wire rods, 5 mm. (0.2 in.):						
Belgium	7	5	to 10	7½	33.64	to 48.14
Wire nails (keg basis):						
Germany	0	14½			3.36	
Belgium	0	20½			4.76	
Angles:					C. per Lb.	
Belgium	7	7½			1.53	
Tees:						
Belgium	8	5			1.71	
Merchant bars:						
Belgium, Mar., Apr.	6	15			1.40	
Luxemb'g, Mar., Apr.	6	12½	to 6	15	1.37	to 1.40
France, Mar., Apr.	6	12½	to 6	15	1.37	to 1.40
Germany, Mar., Apr.	6	15			1.40	
Joists (beams):						
France, Jan., Feb.	5	15	to 6	0	1.19	to 1.24
Belgium, not quoted.						
Luxemburg, not quoted.						
Germany, not quoted.						
Channels:						
Belgium	7	10	to 7	12½	1.55	to 1.58
⅜-in. plates:						
Germany, Feb., Mar.	6	12½	to 6	15	1.37	to 1.40
Belgium, Jan., Feb.	7	0			1.45	
Luxemb'g, Feb., Mar.	6	10			1.35	
France, not quoted.						
No. 8 gage wire:						
Belgium	14	10⅝			3.01	

COAL CONDITIONS

Bituminous Situation Satisfactory—Still Complaining of Car Shortage

WASHINGTON, Jan. 2.—The bituminous coal situation generally is in good shape, while the clamor for anthracite is urgent, according to the report of Federal Fuel Distributor C. E. Spens to President Harding which accompanied the resignation of Mr. Spens, effective Jan. 1. The office of the Federal Fuel Administrator will be continued for a month or so, according to requirements, but will devote its energies chiefly to the anthracite situation.

Complaints continue of shortage in car supply, Mr. Spens pointed out, but there are few complaints of current shortage of bituminous coal. There is, however, he said, a demand by industry, particularly public service corporations, in certain sections, for greater opportunity to increase reserves, due to a large extent to anticipated renewal of labor troubles this coming spring.

"With the seasonal reduction in other traffic, which this year, however, has been greatly retarded," the report stated, "additional power should be released for the transportation of coal, and while this power generally is not yet up to standard due to the shopmen's strike, barring extreme weather, which, of course, would further affect the railroads' capacity, we are hopeful that the situation may be cared for without serious distress. Difficult weather might result quite seriously."

Bituminous production in 1921, it is stated, was 415,000,000 tons while the production in 1922 up to and including Dec. 16 was 387,152,000 tons. Production now is at the rate of approximately 11,000,000 tons weekly, while current consumption is estimated at from 8,500,000 to 9,000,000 weekly.

Commenting on the condition of cars, the report contains the following percentages indicating the improvement in the matter of repair to open top cars since Sept. 1 up to Dec. 1:

Date	Bad Order Open Tops	Per Cent
Sept. 1	140,887	14.8
Sept. 15	134,714	14.2
Oct. 1	127,407	13.3
Oct. 15	117,665	12.4
Nov. 1	109,967	11.5
Nov. 15	105,174	11.1
Dec. 1	101,470	10.5

There has been a continuous decline in the percentage of cars in bad order—the reduction from Sept. 1 to Dec. 1 being 4.3 per cent.

"Comparative Tests Of Steels At High Temperatures," by R. S. MacPherran, chief chemist, Allis-Chalmers Mfg. Co., Milwaukee, and "Annealing Gray Cast Iron," by J. F. Harper and R. S. MacPherran, make up bulletin No. 241 of the Allis-Chalmers company. The tests were made in the company's laboratories in a study of the properties of various materials under special conditions. The results of the investigations have been presented before several technical societies.

PERSONAL

Edward Gross, for the last 21 years connected with the St. Louis office of Rogers, Brown & Co., calling on the trade in part of Missouri, Iowa and Illinois selling pig iron, coke, alloys and smithing coal, is now associated with the sales department of the St. Louis Coke & Chemical Co. as assistant to Walter H. Underwood, general sales manager. The latter concern's plant, producing Frances foundry, basic and malleable pig iron and Roberts by-product coke, is at Granite City, Ill., with sales office in Boatmen's Bank Building, St. Louis.

EDWARD GROSS

Frank L. Morey, secretary the Commonwealth Steel Co., St. Louis, will assume the duties of treasurer under a recent readjustment in management. George K. Hoblitzelle, who has been vice-president and treasurer, will be manager of purchases and supplies, and also assistant treasurer. C. R. Pilsbury has been appointed general auditor at both plant and city offices.

E. A. Hanff, formerly electrical engineer with the Pittsburgh Electric Furnace Corporation, is now with the electric furnace department of William Swindell & Brothers, Pittsburgh.

Guy A. Hager, formerly district sales manager of the Lackawanna Steel Co.'s Buffalo office, has been appointed northwestern representative of the Columbus-McKinnon Chain Co., with headquarters in Chicago.

J. M. Jones, president Eastern Rolling Mill Co., Baltimore, was elected president of the Baltimore Tube Co., Baltimore, by the board of directors Dec. 27. He was also made a member of the board, effective Jan. 1, and succeeds C. S. Morse, retired president. Mr. Jones will continue his activities as president of the Eastern Rolling Mill Co.

Ralph L. Glaser, who for several years has been Connecticut sales representative of the Warner & Swasey Co., Cleveland, has been appointed New England district manager with headquarters in the Oliver Building, Boston, effective Jan. 1. He succeeds the late H. L. Kinsley.

Arthur H. Keetch, sales representative of the Warner & Swasey Co., in Buffalo territory, with headquarters in the Iroquois Building, Buffalo, has been appointed district sales manager of the Buffalo and Pittsburgh districts, effective Jan. 1.

Frederick E. Brown, assistant to vice-president, National Tube Co., has been elected a director and vice-president of the Pittsburgh Knife & Forge Co., Pittsburgh, Pa.

P. B. Rhoades has been appointed Cleveland district sales manager of the Williamsport Wire Rope Co., Williamsport, Pa., which has opened a Cleveland sales office and warehouse at 1535 East Fifty-fifth Street. He has been connected with the Bourne-Fuller Co., Cleveland, for twenty years. Associated with him is Harry C. Williamson, who has been connected with the Betz-Pierce Steel Co., Cleveland.

Clarence L. Collens, 2d, president Reliance Electric & Engineering Co., Cleveland, has been in Europe several weeks attending the conference of the Electro-Technical Commission in Geneva, and a meeting of electrical manufacturers in London. He is expected home about Jan. 15.

S. W. Manss has been appointed purchasing agent of the Laclede Steel Co., St. Louis, effective Jan. 1.

David B. Day, Canton, Ohio, attorney, has been elected a member of the board of directors of the United Alloy Steel Corporation, Canton, to succeed Harry R. Jones. Mr. Day has acted as general counsel for the corporation since its organization.

Marvin E. Monk, formerly assistant sales manager, has been promoted to director of sales of the U. S. Ball Bearing Mfg. Co., Chicago.

Philip A. Hill, who has been connected with the National Malleable Castings Co., in the Chicago district during the last sixteen years, has affiliated with the Superior Steel Castings Co., Benton Harbor, Mich. Having had contact with the operating, production and sales departments, his experience has covered a wide range. His headquarters will be at Benton Harbor.

By the reorganization effected in the general manufacturing department of the General Electric Co., Schenectady, N. Y., H. F. T. Erben, previously manager of the Schenectady Works, becomes vice-chairman of the manufacturing committee, of which vice-president G. E. Emmons is chairman. Charles E. Eveleth, who was assistant works manager under Mr. Erben, will be manager at the Schenectady works. A sub-committee was appointed which will function in conjunction with the manufacturing committee and will be known as the committee on appropriations.

F. H. Moyer resigned recently as assistant works manager, Pittsburgh Crucible Steel Co., Midland, Pa., in direct charge of engineering and service departments, to become chief engineer United Alloy Steel Corporation, Canton, Ohio, assuming the position Jan. 1. Mr. Moyer has been active in the steel industry along mechanical and engineering lines since 1899, when he was graduated from Cornell University. He has held the position of chief engineer of the Clairton, Pa., works, Carnegie Steel Co., Indiana Steel Co., Gary, Ind., and the Cambria Steel Co., Johnstown, Pa. In the last named connection, he had charge of plant rebuilding and extensions from 1916 to 1920.

OBITUARY

JOSEPH E. RALPH, head of the labor department of the United States Steel Corporation, died suddenly at 71 Broadway, New York, on Dec. 30, aged 59 years. Mr. Ralph was at one time employed by the Joliet Steel Co., which in 1889 was absorbed by the Illinois Steel Co. For 28 years he was connected with the Bureau of Engraving and Printing at Washington, for 12 years being one of its directors. For eight years prior to his resignation in 1918, he was chief of the bureau. He had been head of the labor department of the Steel Corporation for about four years.

C. A. MILLER, 47, of McDonald, Trumbull county, Ohio, superintendent of the McDonald bar mills of the Carnegie Steel Co., died Dec. 28, at Youngstown, following a prolonged illness. He had been ill during the summer, but returned to his office a month ago. For twenty years he had been in the company's employ and had assisted in designing and building the McDonald plant. Mr. Miller was made superintendent in 1918 when operations were begun.

SAMUEL RAYNOR, assistant treasurer Builders Iron Foundry, Providence, R. I., died Tuesday night, Dec. 26, at his home on Taber Avenue, that city. Mr. Raynor was born in New York about 50 years ago, and some 20 years ago went to Providence to assume office management for the Foundry company. Three years ago he was made assistant treasurer.

THOMAS J. RAY, vice-president and general manager, Peck, Stow & Wilcox Co., Cleveland, manufacturer of builders' hardware and mechanics' tools, died Dec. 23, after a week's illness, age 45 years. He had been connected with the company 25 years.

The partnership known as Frank Samuel, 200 Harrison Building, Philadelphia, has changed its name to Frank Samuel & Co., which for many years has been prominent in the selling of ferroalloys, manganese ore and iron and steel scrap. The partners are Frank Samuel, S. M. Tomlinson and S. A. Cochran.

E. A. S. Clarke Elected Secretary of the American Iron and Steel Institute

E. A. S. Clarke has been elected secretary of the American Iron and Steel Institute. The announcement made by E. H. Gary, president of the institute, on Dec. 28 was as follows:

"E. A. S. Clarke, one of the directors of the American Iron and Steel Institute, lately in charge, as president, of the activities of the Consolidated Steel Corporation, now in liquidation, and formerly president of the Lackawanna Steel Co., has been duly elected secretary of the institute."

E. A. S. CLARKE

The position to which Mr. Clarke has been elected has been vacant since the resignation of James T. McCleary in May, 1920.

Mr. Clarke comes to the position of secretary of the institute after a long and varied experience in the steel business. He was born at Ottawa, Canada, Jan. 1, 1862, and after preliminary schooling in Philadelphia and abroad, went to Harvard University, from which he graduated in 1884, receiving the degree of Bachelor of Arts. In that year, he entered the employ of the Spang Steel & Iron Co., Sharpsburg, near Pittsburgh, and continued until June, 1885, when he became connected with the Union Steel Co., Chicago, which afterwards was merged into the Illinois Steel Co., of which he became general manager. In 1900 he became general manager of manufacturing of the Deering Harvester Co. and about three years later entered the service of the International Harvester Co., where he organized and built up the Wisconsin Steel Co., a subsidiary company of the Harvester company. In December, 1904, he became president of the Lackawanna Steel Co. During the time of his presidency the Lackawanna company was radically changed and improved. While the number of blast furnaces was increased from seven to nine and the production of steel correspondingly, fully as important a change was made in the character of the product, which was changed from Bessemer to open-hearth. The position of the company financially was also vastly improved. In 1904 it had no surplus and at the end of 1918 it had a surplus of $34,000,000. New ore properties were acquired, many additions to plants were made and several less valuable properties sold.

Mr. Clarke resigned as president of the Lackawanna Steel Co. Jan. 1, 1919, in order to accept the presidency of the Consolidated Steel Corporation, which was organized as the exclusive sales agency for exporting the merchant iron and steel products of 10 companies whose combined ingot capacity is about 12,000,000 tons. The corporation enjoyed great prosperity for a year or more, but as export business in general declined and several of the companies decided that they would prefer to handle their own export business to Canada, it was decided to liquidate the business. Mr. Clarke has been actively engaged in this work and will so continue until about Feb. 1, when he will take up his new duties as secretary of the institute.

Mr. Clarke has been an active member of the American Iron and Steel Institute since its organization and throughout the period of the great war was secretary of its most important committee, that on Steel and Steel Products, which cooperated with the Government in price fixing. His duties as secretary were extremely arduous. He worked with untiring energy and with such success as to receive the highest commendation from officials of the Government and manufacturers of iron and steel products. His experience gained in this patriotic work will be of great value to him in the discharge of the duties of his new position.

McKinney Steel Co. Will Build Two New Blast Furnaces

The McKinney Steel Co., Cleveland, plans to build two new 600-ton blast furnaces to replace its two old River furnaces, which will be torn down. Bids have been asked for the two stacks and contracts will probably be placed within the next week or two. The company's old Nos. 1 and 2 hand-fired River furnaces, which are to be replaced with modern skip filled stacks, were built in 1909-11, and have a daily capacity of 400 tons each. The new furnaces will be practically duplicates of the company's Nos. 3 and 4, 90 x 22 ft. furnaces built in 1915-16.

The McKinney Steel Co. since it built its steel works, completed in 1916, had planned to add a finishing department in order to convert at least a portion of its semi-finished steel into some form of finished product, but with its decision to re-build two blast furnaces this year, it has postponed other building plans so that it is not probable that any steps will be taken in 1923 toward the erection of a finishing department.

Jones & Laughlin Steel Corporation Officials Elected

Reorganization of the Jones & Laughlin Steel Co. into the Jones & Laughlin Steel Corporation was completed through the election of officers on Jan. 1, at the company's offices, Pittsburgh. B. F. Jones, Jr., president of the old company, has been elected chairman of the board of directors of the new one; William Larimer Jones, vice-president of the old company, is president of the new organization, the vice-presidents of which are Willis L. King, G. M. Laughlin, Jr., W. C. Moreland, Charles A. Fisher, and S. E. Hackett. B. F. Jones, III, has been named secretary, and J. C. Watson treasurer of the new company. W. C. Moreland was secretary of the old company and B. F. Jones, III, assistant secretary and assistant treasurer. W. J. Creighton has been made assistant secretary and F. D. Cumming, F. M. Harbison and J. S. Brown assistant treasurers.

Machine-Tool Industry Partially Recovers

Last Year One of Transition from the Depression of 1921— Considerable Headway Made in Last Half —Prospects Improving

OUTSTANDING in the partial recovery of the machine-tool industry from the depression of 1921 was the large buying of shop equipment by some of the leading railroad companies during 1922. Orders from the railroads brought some months of the year almost up to normal with those companies which specialize in railroad shop equipment.

With many of the machine-tool builders recovery was a slow and painful process, which had not reached a satisfactory status even at the end of 1922. The industry has been buoyed up, however, by hope that 1923 has better business in store, and there are tangible indications in the shape of inquiries now pending to give some sound basis for optimism as to future developments.

Buying by the automobile industry was far less than during some previous years owing to the fact that motor vehicle manufacturers did not see the need for further expansion despite the record-breaking demand for cars. However, a few automobile companies bought round lots of shop equipment for new units and others purchased a fair quantity of machine tools in small lots to round out their plants, or to replace old equipment with improved machinery that would reduce manufacturing costs. In this connection, there was a pronounced inclination toward automatic or semi-automatic machines.

Makers of electrical household appliances bought a fair quantity of new equipment, and there was considerable buying by makers of plumbers' brass goods, and by manufacturers of other products used in the building industry. Buying of machinery for equipping manual training schools was probably heavier than in any previous year.

Railroad buying assumed large proportions, especially in the Chicago district. Large lists placed during the year totaled several millions of dollars, and there were numerous purchases of single machines for which no reliable estimate as to value can be made.

Liquidation sales of machine tools by companies which went out of business and sales of surplus tools by the Government had a pronounced effect upon the market throughout all of the year. There was a tendency among many buyers to prefer used machines in good condition to new machines because of the considerable saving in price; hence the orders actually booked by the tool builders do not properly reflect the volume of machine-tool buying during the year.

Prices were weak during a good part of the year, but in the latter three or four months showed stronger tendencies, and a good many advances were put into effect. It was a year in which business largely had to be developed by the seller, and good salesmanship and hard work entered into the success of every machine-tool business to a larger extent than had been experienced since before the war.

New York

NEW YORK, Jan. 2.

THE last week of the old year brought no developments of importance in the local machine-tool market. Business was quiet, as is usually the case during holiday week, but the trade enters upon the new year with more optimism than it has shown in considerable time. A good many inquiries, on which action is expected during January, are pending. No orders have been placed by the Delaware, Lackawanna & Western Railroad, but these are expected this week. The recent inquiries of the General Electric Co., mentioned last week, total 15 to 20 tools. The American Welding Co., 30 Church Street, New York, is in the market for complete machine-shop equipment, particularly boring mills, lathes, drilling machines, milling machines and electric and gas welding outfits.

The market on both locomotive and electric overhead cranes has been exceedingly quiet the past week. A few closings are reported but few new inquiries. There is an inquiry current from the W. S. Wetenhall Co., 706 Atlas Building, San Francisco, for a 5-ton 45-ft. 6-in. span overhead traveling crane for handling reinforcing bars. The General Electric Co., is reported to have awarded the 60-ton overhead traveling crane for Pittsfield, which has been pending for some time.

Among recent purchasers are:

Curran Bros. & Murphy, Brooklyn, N. Y., a used 10-ton Shepard overhead traveling crane from Dwight P. Robinson, Inc., New York; Ophuls & Hill, 112 West Forty-second Street, New York, 14 2800-lb. capacity, 26-ft. 6-in. span, 2-motor, overhead traveling cranes with electric hoists for the Arctic-Hygeia Ice Co., New York, from the American Engineering Co., Philadelphia; Stone & Webster, Inc., Boston, Mass., a 75-ton, electric traveling crane from the Northern Engineering Works; Dwight P. Robinson, Inc., New York, a 30-ton, 50-ft., 70-ft. and 90-ft. extension boom, for Ashland, Ky., from the Industrial Works.

The Studebaker Corporation of America, 1700 Broadway, New York, is preparing plans for a new five-story and basement service and repair building on Broadway, 131st to 132nd Street, estimated to cost $700,000. The W. S. Ferguson Co., 1900 Euclid Avenue, Cleveland, is architect and engineer.

The Brooklyn Edison Co., 360 Pearl Street, Brooklyn, will take bids in January on a general contract for its new power plant at Marshall Street and Hudson Avenue, 175 x 290 ft., with initial capacity of 100,000 kw., estimated to cost $10,000,000. Thomas E. Murray, Inc., 55 Duane Street, New York, is engineer. G. L. Knight, company address, is consulting engineer.

The Husid Co., Graham Avenue, Brooklyn, sheet iron and metal products, has filed plans for a new two-story building, 20 x 185 ft., on Church Street, Jamaica, L. I., to cost about $22,000.

The American Gas & Electric Co., 30 Church Street, New York, has acquired a controlling interest in the Ohio Service Co., with power plant and system in the vicinity of Dover, Ohio, heretofore operated by the United Service Co., Scranton, Pa. The new owner plans for extensions and improvements in the power plant and system, in conjunction with the Ohio Power Co.

The F. L. Smithe Machine Co., Eleventh Avenue and Twenty-first Street, New York, manufacturer of paper-working machinery, etc., has acquired property, 127 x 215 ft., at Twelfth Avenue and Forty-fourth Street, for a new five-story plant. Ferdinand L. Smithe is head.

The Fuller & Warren Co., foot of Monroe Street, Troy, N. Y., manufacturer of stoves, ranges, etc., has preliminary plans for rebuilding the portion of its plant recently destroyed by fire with loss estimated at $60,000.

Motors and other electrical equipment, conveying machinery, etc., will be installed in the new printing plant to be erected on Woodside Avenue, Long Island City, by the Latham Lithographing & Printing Co., 32 West Forty-second Street, New York, estimated to cost $1,000,000, with equipment.

George Tippett, 147 Broadway, Astoria, L. I., manufacturer of heating equipment, will commence the erection of a two-story addition, 40 x 75 ft., estimated to cost $25,000.

The Bureau of Supplies and Accounts, Navy Department, Washington, will receive bids until Jan. 23 for a quantity of steel crankshafts for use at the Brooklyn Navy Yard.

The Fulton Ice Co., 18 East Forty-first Street, New York, will soon take bids for a new plant at 138-40 Cherry Street, to cost about $100,000, including machinery. Ophuls &

Hill, 112 West Forty-second Street, are engineers. James W. Scott is president.

Beith & Reilly, 2475 Third Avenue, New York, pipe, heating and plumbing equipment, etc., have taken bids on a general contract for a new three-story building, 100 x 100 ft., at Lincoln Avenue and 137th Street, to cost $120,000, including equipment. John P. Boyland, 120 East Fordham Road, is architect.

Motors, controllers, conveying and other equipment will be installed in the new printing plant to be erected on North Broad Street, Elizabeth, N. J., by the Elizabeth Daily Journal, 74 North Broad Street, estimated to cost $200,000. C. Godfrey Poggi, 275 Morris Avenue, is architect.

The Layne & Bowler Pump Co., Chelsea Avenue, Memphis, Tenn., manufacturer of pumping machinery, screening equipment, etc., will commence the erection of a one-story branch plant at Linden, N. J., to be operated by the Layne-New York Co., a subsidiary.

The Public Service Electric Co., Public Service Terminal, Newark, will commence the erection of a three-story addition to its Point-No-Point power plant to cost in excess of $1,000,000, including machinery. N. A. Carle is chief engineer.

The Board of Education, City Hall, Newark, is planning for the installation of additional equipment at the Seymour vocational school, Sussex Avenue, using the remainder of a $250,000 fund, initially planned, of which $108,000 has been expended, to include equipment for the foundry, machine shop, automobile repair shop, sheet-metal working department, electrical shop and drafting room.

An appropriation of $300,000 has been arranged by the Pittsburgh Plate Glass Co., Frick Building, Pittsburgh, and 290 Elizabeth Avenue, Newark, for a new linseed oil mill, now in course of construction on Chester Avenue, Newark, to include elevators and machinery, loading crane and other equipment.

Philadelphia

PHILADELPHIA, Jan. 2.

CONTRACT has been awarded by the Margerum Motor Co., York Road, Philadelphia, to the A. Raymond Raff Co., 1635 Thompson Street, for a service and repair plant at Broad Street and Sixty-fifth Avenue, to cost $80,000.

The Electric Power Equipment Corporation, Thirteenth and Wood Streets, Philadelphia, manufacturer of electrical apparatus, has taken title to the one and two-story factory and office building at Eighteenth and Shamokin Streets, on site 72 x 268 ft., for $70,000, for a new plant.

The De Bear Motor Car Co., 219-25 North Broad Street, Philadelphia, local representative for the Maxwell and Chalmers automobiles, has construction under way on a new building at Thirty-first and Thompson Street, to be used exclusively as a machine repair and service works. A temporary service department is now being operated at 1316 Poplar Street.

A power plant will be constructed by the Philadelphia & Reading Railroad Co., Reading Terminal, Philadelphia, at its new terminal at Camden, N. J., estimated to cost $3,000,000. Four electrically-operated ferry slips will be installed.

The Jointless Fire Brick Co., 1130 Clay Street, Chicago, has purchased about two acres at Trenton, N. J., as a site for the erection of a fire brick and refractory plant, estimated to cost $75,000.

The Bureau of Accounts and Supplies, Navy Department, Washington, will receive bids until Jan. 9 for 60 airplane wheels for the Philadelphia aircraft plant.

R. E. Wallace, 33 South State Street, Wilkes-Barre, Pa., is taking bids on a general contract for a new two-story plant, 30 x 130 ft., for the manufacture of automobile bodies. McCormack & French, Second National Bank Building, are architects.

A manual training department will be installed in the new high school to be erected at Windber, Pa., estimated to cost $200,000, for which plans are being drawn.

A one-story power plant, steam-operated, will be constructed by the Keystone Macaroni Co., Lebanon, Pa., in connection with its new factory at Eighth and Water Streets. Charles E. Schaup, 222 Market Street, Harrisburg, Pa., is architect.

The Glosser Motor Car Co., 248 William Street, Williamsport, Pa., is planning the erection of a three-story machine repair shop and service works, 45 x 66 ft., to cost about $50,000. S. A. Glosser heads the company.

A manual training department will be installed in the new two-story high school to be erected at Jersey Shore, Pa., estimated to cost $150,000.

The West Shore Lumber Co., Lemoyne, Pa., plans the construction of a one-story power house.

The Monessen Foundry & Machine Co., Monessen, Pa., will commence the construction of a one-story addition, 32 x 100 ft., for use in foundry operations.

A manual training department will be installed in the new high school to be erected at Enola, Pa., estimated to cost $75,000. H. L. Hoffman is secretary of the school board.

Chicago

CHICAGO, Jan. 2.

FEW orders for machine tools were placed the last week of 1922, but the outlook for January is regarded as favorable. The Missouri Pacific is expected to take early action on its list of 53 items and the Union Pacific is asking for quotations in connection with the preparation of its 1923 budget. Railroad car builders and various railroad supply manufacturers are showing more interest in the market, with the likelihood that some buying will result. The new plants of the Pettibone-Mulliken Co. and the Ford Motor Co. will undoubtedly involve considerable equipment.

No further price advances have been reported, but a number are expected in the near future. A line of disk grinders will go up about 10 per cent Jan. 15, and a general advance in planers is regarded as imminent.

The American Steel Foundries has placed orders for two 75-ton trolleys for its Chester, Pa., plant.

The Ford Motor Co., which is about to erect a large plant at Hegewisch, Ill., is also completing arrangements to build an assembling unit on the Mississippi River at St. Paul, Minn. The project will involve an ultimate expenditure of $10,000,000. The Ford assembling plant at Minneapolis, it is understood, will be moved to St. Paul. A new assembling unit is also planned for St. Louis.

The Studebaker Corporation, South Bend, Ind., is about to let contracts for a building 700 ft. long and four stories high, to replace the old portion of the plant along the New York Central right-of-way.

Fire of unknown origin recently damaged the machine shop of the S. & J. C. Atlee Lumber Co., Ft. Madison, Iowa, causing a loss estimated at from $3,000 to $5,000.

The Kitselman Brothers Co., wire manufacturer, Muncie, Ind., has purchased the plant of the Pioneer Pole & Shaft Co., Liberty Street and the Big Four Railroad, and will use it to enlarge its wire manufacturing capacity.

The plant of the Rice Box & Basket Co., English, Ind., was destroyed by fire Dec. 19 with a loss estimated at $100,000.

The works of the J. S. Morris Carriage Co., Waupun, Wis., was destroyed by fire Dec. 20. The loss is said to exceed $75,000.

The Western Electric Co., Hawthorne, Ill., is preparing plans for a one-story machine shop to cost $100,000.

The Enameled Street Sign Co. and the Advertising Art Bulletin Co., 190 North State Street, Chicago, have had plans prepared for a one-story factory and boiler house, 163 x 239 ft., on Ravenswood Avenue, to cost $100,000.

The Advance Window Frame Co., 1820 West Austin Avenue, Chicago, has let contract for a one-story factory, 112 x 125 ft., at 4449-89 West Division Street, to cost $30,000.

N. A. Strand & Co., manufacturers of vibrators and other machinery, 631 West Jackson Boulevard, Chicago, are taking bids through David Mahaffey, 118 North La Salle Street, on a two-story factory, 79 x 80 ft., at Argyle and Lincoln Streets, to cost $50,000.

Abraham I. Epstein, represented by Marks & Co., 712 West Madison Street, Chicago, has purchased property running from Morgan to Sangamon Streets, just south of Madison Street, and will erect an automobile service station to cost $150,000.

The United Butchers' Packing Co., 1152 Fulton Street, Chicago, has let a contract for the construction of a four-story packing plant, 50 x 100 ft., to cost $125,000.

The A. B. Dick Co., manufacturer of mimeographs, 730 West Jackson Boulevard, Chicago, has purchased property, 99 x 165 ft., adjoining its plant, on which is a seven-story building.

The Battery Products Co., 5425 South State Street, Chicago, recently incorporated with $100,000 capital stock, is a continuation of the former Battery Parts Co. of the same address. It manufactures storage battery charging clips, radio clips, battery terminals, connections and cable leads, and recently completed an addition which is being used as a foundry. No new equipment will be bought at this time. Officers are H. E. Walker, president and treasurer; H. O. Walker, vice-president, and E. J. Cole, secretary.

The Welch Brothers Co., North Chicago, Ill., recently incorporated with $45,000 capital stock, is a reorganization of a partnership of the same name. The company has enlarged its quarters, having constructed a one-story building, 50 x 100 ft. Officers are Michael E. Welch, president; James G. Welch, vice-president, and H. Irving Welch, secretary and treasurer. The company conducts a wood and metal pattern business, and is also putting on the market a putty gun, a tool to replace the putty knife.

The Mount Vernon Car Mfg. Co., Mount Vernon, Mich., has awarded contract to the Hughes-Foulkrod Co., Oliver Building, Pittsburgh, for a one-story addition, 150 x 500 ft., estimated to cost $250,000, including machinery. W. C. Archer is president.

The Middle West Utilities Co., 72 West Adams Street, Chicago, operating the Michigan Gas & Electric Co., and other properties, has acquired a site on the St. Joseph River, near Mottville, Mich., for a hydroelectric power plant estimated to cost $400,000.

Herbert C. Coy, 3140 South Canal Street, Chicago, will take bids for a one-story machine shop, 32 x 110 ft., at 8831 Norman Avenue. J. T. Fortin, 600 Blue Island Avenue, is architect.

The Western Clock Co., La Salle, Ill., is taking bids for a new two-story and basement plant at Peru, Ill., to cost $250,000, including machinery. It specializes in the manufacture of metal alarm clocks and clock movements. V. A. Matteson, 8 South Dearborn Street, Chicago, is architect.

The Northern States Power Co., St. Paul, Minn., has surveys nearing completion for a steam-operated electric generating plant on the Mississippi River, near St. Paul. Plans are also under way for the erection of a hydroelectric power plant on the St. Croix River, vicinity of St. Paul. The two stations will cost about $10,000,000.

A vocational department will be installed in the new high school to be erected at Ely, Minn., estimated to cost $600,000. H. J. Lockhart, clerk of the school board, is in charge.

A vocational department will be installed in the two-story high school to be erected at Oelwein, Iowa, estimated to cost $200,000. William Gordon, 519 Hubbell Building, Des Moines, is architect.

The St. Paul Gas & Electric Co., St. Paul, Minn., has acquired a site on the Mississippi River, near the city limits, for a new hydroelectric generating plant, estimated to cost $1,250,000.

New England

BOSTON, Jan. 2.

THE year 1922 wound up with little activity in the machine tool market. The purchase of two Northern cranes, one 60-ton and the other 10-ton, by Stone & Webster for a Western plant; the closing of bids on a moderately large list of metal and wood-working mechanical training equipment for an Everett, Mass., school; the sale of a used 13-in. lathe to a Boston manufacturer, and perhaps a dozen other used tools, in lots of one and two, to various concerns nearby; an inquiry for a few fairly large pieces of equipment through a broker, supposedly for the Middlesex & Boston Street Railway Co., and the offering of 28 standard tools, surplus equipment, at extremely low prices, by a New Haven manufacturer of metal specialties, constitute the high spots in the market the past week.

Nor is much activity anticipated in this territory until after the middle of this month, when it is expected the leading industries will have finished inventory taking. The aggregate amount of business supposedly under negotiation is encouraging, and the trade is of the opinion that a large percentage of this will be closed within the next two or three months.

The lull in small tools and parts noted last week was temporary. Business is again active, and individual orders in a majority of cases total up well in dollars and cents.

The Norton Co., Worcester, has issued a new price list, effective Jan. 1, on abrasives. Some advances and some declines are shown, the new list representing a readjustment and balancing more than anything else. The Brown & Sharpe Mfg. Co., Providence, R. I., has issued a new list on micrometers, in which reductions on various items are noted. The 1-in. micrometer is now listed at $6.75.

The W. F. Concannon Shear Co., Milford, Conn., has leased manufacturing quarters in Ogden and Knowlton Streets, Bridgeport, Conn., in which new equipment will be installed. The company started business about a year ago, and has sufficient business on its books to insure full operation for at least six months.

The plant of the William E. Quinn Co., Northampton, Mass., saws, is to be remodeled and extended. In addition, the firm plans to act for the Clark Brothers Co., Olean, N. Y., in the distribution of band saw machinery both in this country and abroad

The Hunt-Spiller Mfg. Co., 383 Dorchester Avenue, Boston, manufacturer of iron castings, has work under way on a two-story addition, estimated to cost $25,000. Wallace L. Gifford is president.

The Central Maine Power Co., Augusta, Me., has acquired the plant and property of the Lincoln County Power Co., operating at Boothbay, Southport and vicinity. It proposes to make extensions and improvements in the power plant at Damariscotta Mills and other properties.

The Lacey Mfg. Co., Fairfield Avenue and Middle Street, Bridgeport, Conn., manufacturer of tools, dies, etc., is planning for the early removal of its plant to a new building on Union Avenue, where the capacity will be considerably increased.

The Berkshire Products Co., Eagle Street, Pittsfield, Mass., comprising a recent merger of the J. & B. Co., and the Berkshire Magneto Co., manufacturers of electrical equipment, has plans for an addition to the present J. & B. plant, where operations will be concentrated, estimated to cost $75,000. J. M. Vance, 24 North Street, is architect.

The E. Howard Clock Co., 206 Eustis Street, Roxbury, Mass., has commenced work on a five-story addition. J. H. McNaughton, 177 State Street, Boston, is architect.

A vocational department will be installed in the new three-story junior high school to be erected at Fall River, Mass., estimated to cost $700,000. Nathaniel C. Chase, 47 Borden Block, is architect.

Fire, Dec. 26, destroyed a portion of the locomotive and car repair shops of the Central Vermont Railroad Co., St. Albans, Vt., with loss estimated at $100,000, including equipment.

The town of Sharon, Conn., will install a manual training department in the new $50,000 junior high school to be erected. Russell F. Barker, 43 Farmington Avenue, Hartford, Conn., is architect.

A. D. Brochu, 258 Windsor Avenue, Hartford, Conn., machinist, will erect a one-story, 60 x 100 ft. brick and steel machine shop on Hillside Avenue.

Pittsburgh

PITTSBURGH, Jan. 2.

THE local machine tool trade takes encouragement from the business it believes is immediately ahead rather than that which has actually been done during the last two weeks. There is a huge volume of pending business, but inventory taking time is not a money spending period. So many inquiries quoted against over the past six months have not been closed that with the tenor of general business of an optimistic vein, the feeling is that 1923 will be productive of good business.

Frank I. Ellis, Farmers Bank Building, Pittsburgh, is engineer for the plant changes and extensions of the Columbia Steel Co., San Francisco, and the Metal & Thermit Corporation, on the Pacific Coast. Requests for prices for estimating purposes have gone out against a 6-unit sheet mill and the auxiliary equipment for such a plant.

The J. N. Chester Engineers, Pittsburgh, has recommended to the city of Wheeling, W. Va., that the power equipment for the new water filtration plant of that city, consisting of six motor-driven centrifugal pumps, equipped for high and low lift service, be awarded the Worthington Pump & Machinery Corporation.

The Gifford-Woods Co., Oakmont, Pa., manufacturer of ice-handling tools, is in the market for a special crane of small capacity.

The American Rolling Mill Co., Middletown, Ohio, in addition to several cranes wanted in connection with the rehabilitation of its Ashland, Ky., works, desires for early delivery a 30-ton crane with 15 ton auxiliary, 4-motor, 60 ft. 8 in. span, to serve the existing sheet mill.

The Superior Auto Accessories Co., 1342 Forbes Street, Pittsburgh, manufacturer of automobile equipment and operating a service works, has awarded contract to Conley & DeMey, 127 North Hiland Avenue, for a one-story structure, 100 x 145 ft. and 78 x 120 ft., on the Baum Boulevard, to cost $55,000.

The Standard Seamless Tube Co., 313 Sixth Avenue, Pittsburgh, is planning the erection of an addition to its plant at Ambridge, Pa., estimated to cost $75,000. H. E. Wharton is engineer.

The Wheeling Ice & Cold Storage Co., Wheeling, W. Va., recently acquired by new interests, has tentative plans for remodeling its plant, including the installation of additional equipment. W. M. B. Sine and G. A. Williams head the company.

The Evans Lead Co., Charleston, W. Va., has plans under consideration for the erection of two additional units. The first unit recently was completed and is being placed in operation. The work is estimated to cost $45,000.

The Duquesne Electric & Mfg. Co., 6428 Hamilton Avenue, Pittsburgh, has filed plans for a one-story addition.

The Belgrade Glass Co., Buckhannon, W. Va., is planning for the construction of a new one-story plant 95 x 310 ft.

The City Council, Martinsburg, W. Va., is considering the installation of new electrically-operated pumping machinery in connection with extensions and improvements in the waterworks.

Motors, controllers, and other mechanical equipment will be installed in the new three-story printing plant to be erected by Smith Brothers, Inc., 409 Grant Street, Pittsburgh. J. M. McCollum, Berger Building, architect, is taking bids on a general contract.

The Shriver Coal Co., Morgantown, W. Va., is planning for the installation of electrical and other equipment at Scotts Run, Monongalia County, comprising about 900 acres, recently acquired for $200,000. Everhart Bier is president.

The Cyclops Steel Co., Titusville, Pa., is planning for the installation of additional equipment for the production of metal and alloy steel specialties. C. T. Evans is plant superintendent.

The Crucible Steel Co. of America is inquiring for a 10-ton, 3-motor, 60-ft. span crane for its LaBelle Works, Pittsburgh, N. S.

Baltimore

BALTIMORE, Jan. 2.

BIDS will be taken within 60 days by the Holland Mfg. Co., 1300 Bank Street, Baltimore, manufacturer of nails, tacks, etc., for a four-story L-shaped addition to cost approximately $40,000.

The Purchasing Agent, Post Office Department, Washington, will receive bids until Jan. 10 for three lifting trucks, capacity 4000 lb.

The General Purchasing Office, Panama Canal, Washington, will receive bids until Jan. 19 for equipment for the Canal Zone, including pumps, steel chain, iron or steel rope and cable, track turnouts, seizing wire, iron or steel pipe, brass and copper tubing, electrical wire, lightning arresters, etc.

The Southern Spindle & Flyer Co., Charlotte, N. C., manufacturer of cotton mill machinery, has plans for a one-story machine shop, 50 x 120 ft., to cost $25,000. The company recently increased its capital to $115,000.

The Lingo City Machine Works, Inc., Wilmington, N. C., will rebuild the portion of its plant recently destroyed by fire.

The Chicago Nipple Mfg. Co., 1966 Southport Avenue, Chicago, has tentative plans for a one-story addition to its new branch factory at First Avenue and Ninth Street, Baltimore, 100 x 190 ft. D. C. Williams is president.

The Georgia Brick Co., Athens, Ga., is planning to rebuild the portion of its plant destroyed by fire Dec. 19, with loss estimated at $40,000, including equipment. R. C. Wilson is head.

The Dashiell Mining & Refining Co., Dunkirk, Md., is planning for the installation of a conveyor system at its local properties. B. J. Dashiell, Baltimore, is consulting engineer in charge.

The Edwards Railway Motorcar Co., Sanford, N. C., has arranged for the establishment of a local plant for the manufacture of a recently-invented motor-car for railway service.

Maryland Motors, Inc., Baltimore, has filed plans for a two-story service and repair building, 98 x 110 ft., at 414-24 North Calvert Street, to cost $55,000.

The Board of Education, Baltimore, has selected about 7 acres between Brooklyn and Curtis Bay as a site for a new industrial and vocational school, for which plans will soon be drawn.

The Appomattox Light & Power Co., Appomattox, Va., is planning to rebuild the portion of its electric light and power plant, recently destroyed by fire. An official estimate of loss has not been made.

The Westinghouse Electric & Mfg. Co., East Pittsburgh, will commence the erection of the superstructure for its new branch at Jones Avenue and Marietta Street, Atlanta, Ga., to be occupied under lease. It will be six stories, 100 x 150 ft., estimated to cost $350,000.

Harry A. Blessing, 317 Woodward Building, Washington, will soon take bids for a two-story automobile service and repair building, 120 x 295 ft., at Wyoming Avenue and Nineteenth Street, N. W., estimated to cost $275,000. Harvey H. Warwick, 1106 Sixteenth Street, N. W., is architect.

The Baltimore & Ohio Railroad Co., Baltimore, has tentative plans for rebuilding the portion of its repair shops at Mount Clare, recently destroyed by fire with loss estimated at $100,000.

The H. M. Wade Mfg. Co., South Graham Street, Charlotte, N. C., manufacturer of show cases, fixtures, etc., is preparing plans for a new four-story factory, 120 x 150 ft., estimated to cost $150,000, including equipment. Lockwood, Greene & Co., Charlotte, are architects and engineers.

The Hackley Morrison Co., Inc., 1708 Lewis Street, Richmond, Va., machinery dealer, has inquiries out for boilers, engines and logging cars for lumber mill service.

Buffalo

BUFFALO, Jan. 2.

THE Spillman Engineering Co., Oliver and Goundry Streets, North Tonawanda, N. Y., manufacturer of caterpillar amusement machinery, will commence the erection of a one-story addition, doubling the present floor area, to be equipped primarily as a machine shop.

Officials of the Robeson Cutlery Co., Anderson Avenue, Rochester, N. Y., have organized the Robeson-Rochester Corporation, with capital of $3,650,000, to manufacture knives, cutlery, tools, etc. It is headed by G. W. Robeson, C. W. Silcox and L. S. Foulkes.

The Paper Board Corporation, Tonawanda, N. Y., is disposing of a bond issue of $500,000, a portion of the proceeds to be used for extensions and improvements.

The W. H. Loomis Talc Co., Main Street, Gouverneur N. Y., will commence the erection of a one-story plant, 40 x 110 ft., to be equipped for grinding, pulverizing, etc., estimated to cost $50,000. W. H. Loomis heads the company.

The General Motors Corporation, Detroit, has acquired a controlling interest in the Brown-Lipe-Chapin Co., Syracuse, N. Y., manufacturer of gears and transmission systems, and will operate the plant under its present name as a subsidiary. H. W. Brown, heretofore general manager, has been elected president.

The Rochester Vulcanite Pavement Co., Sherman Place, Rochester, N. Y., will build a one-story addition for the repair of highway machinery and parts production.

The Bausch & Lomb Optical Co., St. Paul Street, Rochester, N. Y., has acquired an interest in Stevens & Co., Inc., Providence, R. I., manufacturer of similar equipment, and will expand operations at the Providence works.

Cincinnati

CINCINNATI, Jan. 2.

THE machinery market at the close of the year gives promise of better things for 1923. During the past week inquiries were more plentiful than for a similar period for two months or more, and a number of orders, largely for single machines, were booked.

Included in purchases was one for $150,000 by the U. S. Radiator Corporation for an Illinois plant. The Missouri Pacific is reported to have closed on its recent list, the bulk being placed with a large Eastern selling agency. These were the outstanding purchases, although the Chicago, Burlington & Quincy is purchasing against its Eola list, but has not sent out formal orders. A local manufacturer reports an order for five tools from a Detroit automotive manufacturer. The Union Pacific Railroad has issued an inquiry for three large planers and a slab miller. The Big Four is inquiring for four 20 x 8 in. lathes, one 24 x 10 in. lathe, two 48-in. boring mills and one journal turning lathe. The Louisville & Nashville inquiry for lathes is expected to be closed within the next two weeks.

The outstanding inquiry in the crane market is from the American Rolling Mill Co., Middletown, Ohio, which is asking for 15 cranes of special design for its new Ashland plant. Practically all of these cranes will be of 15-ton capacity.

A reorganization of the Kilbourne & Jacobs Mfg. Co., Columbus, Ohio, is in progress, and Paul T. Norton, formerly of the Case Crane & Engineering Co., has been elected president. The company manufactures dump cars and other material handling equipment.

The Clafflin Engineering Co.'s plant, West Lancaster, Ohio, has been purchased by a number of Columbus capitalists headed by Harry Herman. It will be operated by the new owners under the old name and will manufacture tire building machinery as well as other automobile accessories.

The Midwest Casting Co., Middletown, Ohio, producer of malleable castings, is contemplating doubling the capacity of its plant, work to be started early in the spring. H. S. Wise is president.

The American Foundry & Casting Co., Dayton, Ohio, has leased the plant of the Bahman Iron Works Co. for one year, increasing business having made necessary larger quarters.

The Edwards Safety Device Co., Columbus, Ohio, has been incorporated with a capitalization of $250,000 to place on the market a safety device for railroads. The company has not as yet decided whether to manufacture the device or lease its

rights to a railroad company for manufacture. J. C. Gilligan, M. H. Gordon and C. W. Wallace are the principal incorporators.

Fire, Dec. 26, destroyed the forge shop in which was located the hardening, tempering, machine and hand-grinding departments, as well as the forging department of the Clyde Cutlery Co., Clyde, Ohio. The building is a total loss and a major part of the factory furniture, fittings and machinery were destroyed. Within 48 hours after the fire was extinguished a new building was under construction, and a new forge shop is expected to be ready in about 30 days.

Detroit

DETROIT, Jan. 2.

A NEW one-story machine shop will be erected by the Diamond Crystal Salt Co., St. Clair, Mich., 50 x 150 ft., on South Riverside Avenue. Henry Whiting is president.

The Service Caster & Truck Co., Albion, Mich., will commence the erection of a new one-story plant, 50 x 200 ft., to cost $45,000, for the manufacture of factory trucks and similar equipment. H. H. Sheldon, 316 East Porter Street, heads the company.

The Hayes Wheel Co., Jackson, Mich., has acquired the plant and business of the Imperial Wheel Co., Flint, Mich. The properties will be consolidated and both plants maintained in operation.

The New Egyptian Portland Cement Co., 1213 Ford Building, Detroit, will commence work for its new plant at Port Huron, Mich., comprising the remodeling of the former railroad shops, lately acquired, and the erection of additional buildings. John A. Decker, 708 State Street, Port Huron, is consulting engineer. John Gillespie is president.

Robert Finn, 622 McKeachey Building, Detroit, architect, has plans for a one-story foundry, 50 x 140 ft., to cost about $20,000. The name of the owner is temporarily withheld.

The New York Central Railroad Co., Detroit, will make enlargements in its repair shops at Adrian, Mich. The new buildings and remodeling of present structures, with additional equipment, will cost approximately $100,000.

The Freeman Dairy Co., Flint, Mich., will build a one-story power house and cold storage plant at its works on Garland Street. A list of equipment will be prepared. Leon F. Freeman is president.

The Ford Motor Co., Highland Park, Mich., has awarded contract to W. E. Wood & Co., Ford Building, Detroit, for a new one-story assembling plant at Norwood, Ohio, estimated to cost $100,000.

The Gregg Pump Co., Kalamazoo, Mich., is completing remodeling a local factory and will commence the manufacture of pumping machinery and parts at an early date. Walter S. Gregg is president.

Fire, Dec. 20, destroyed the plant of the American Rule & Block Co., Menominee, Mich., with loss estimated at $100,000, including machinery. It is planned to rebuild.

The Detroit Steel Products Co., Detroit, advises that it has not purchased a plant in Holly and has no intention of doing so, as was erroneously reported in these columns Dec. 14.

The Consumers Power Co., Grand Rapids, Mich., is arranging an appropriation of $400,000 for extensions and improvements in its plant and system during 1923, including the installation of additional machinery.

The Central South

ST. LOUIS, Jan. 2.

PLANS are being prepared by the Collier-Adams Mfg. Co., Fourth Street and Mitchell Avenue, St. Joseph, Mo., manufacturer of doors, sash and other millwork products, for a new four-story factory, 65 x 300 ft., to cost approximately $100,000, including machinery. E. Meier, Lincoln Building, is architect.

The Ozark Incubator Co., 45 Elks Arcade, Springfield, Mo., recently organized, has preliminary plans for a local plant, to include a machine shop, metal-working and other departments. It is also proposed to erect another building for the production of brooder stoves. The company is headed by Seth T. Woods and Arthur S. Ferguson.

A manual training department will be installed in the new high school to be erected at Great Bend, Kan., estimated to cost $250,000. Payson & Carswell, 505 Interstate Building, Kansas City, Mo., are architects.

The Cherokee Brick Co., Knoxville, Tenn., recently organized, has acquired about 20 acres in the Chestnut Ridge section, as a site for a new plant to manufacture face brick, tile and kindred products, estimated to cost $200,000, with machinery. Albert Robbins is president.

The Missouri-Kansas-Texas Railroad Co., St. Louis, will take bids in January for a new engine house with repair facilities, and power plant at Franklin, Mo., estimated to cost $90,000. A. L. Sparks, company address, is architect.

A one-story power house will be constructed by the Yahola Sand & Gravel Co., Muskogee, Okla., in connection with its irrigation system on property recently acquired on the Grand River, estimated to cost $200,000. An electrically-operated pumping plant will also be built. W. S. Dills is president.

A manual training department will be installed in the three-story and basement high school, 140 x 190 ft., to be erected at Liberty, Mo., estimated to cost $275,000. C. A. Smith, 602 Finance Building, Kansas City, Mo., is architect.

The Garber Refining Co., Perry, Okla., E. A. Hutcheson, manager, has tentative plans for a new oil refinery.

The Big Four Fluorspar & Ore Co., Farmers' Bank Building, Pittsburgh, will install a mining and milling plant in the La Rue district, Marion, Ky., to cost about $100,000. Grinding and pulverizing machinery will be installed, and a power house erected. A. H. Reed is manager.

A manual training department will be installed in the high school to be erected at Spiro, Okla., estimated to cost $75,000.

The Stout Sign Co., North Twelfth Street, St. Louis, manufacturer of embossed metal signs, has awarded contract to W. C. Harting, St. Louis, for a new plant at 2523 Sullivan Avenue.

The Menzmayer Sheet Metal Works, Junction City, Kan., will commence the construction of a two-story and basement building estimated to cost $20,000. H. Menzmayer heads the company.

The Spring Lick Coal Co., Spring Lick, Ky., recently organized, is planning the installation of electrical and mechanical equipment at its properties near Steff, Ky. George W. Heh[illegible]an, Prospect, Ky., is president.

The New State Ice Co., Oklahoma City, Mo., will build a new ice-manufacturing and cold-storage plant, 125 x 128 ft., estimated to cost $50,000, including machinery. Carl S. Glitsch is manager.

A manual training department will be installed in the new junior high school to be erected on Montgomery Avenue, Ashland, Ky., to cost about $100,000. Tyson & Foster, Grand Theater Building, are architects.

The Gulf States

BIRMINGHAM, Jan. 2.

CONTRACT has been awarded by the Prest-O-Lite Co., Indianapolis, to J. V. and R. T. Burkes, Carondelet Building, New Orleans, for a new plant on local site, to cost $60,000. Other units will be built later.

A manual training department will be installed in the high school to be erected at Canyon, Tex., estimated to cost $100,000. A. Rittenberry, Amarillo, Tex., is architect.

The McWane Cast Iron Pipe Co., Birmingham, has filed plans for a one-story foundry on site recently acquired at East Birmingham, estimated to cost $50,000.

G. N. Thomas, Marianna, Fla., has acquired a site on the Chipola River and plans the construction of a hydro-electric power plant.

The Bastrop Pulp & Paper Co., Bastrop, La., is planning for the installation of additional machinery to provide for an increase of about 50 tons daily capacity. Work is in progress for the erection of a one-story power house.

A vocational department will be installed in the new high school to be erected on Pond Street, Decatur, Ala., estimated to cost $125,000. D. O. Whilldin, Title Guarantee Building Birmingham, architect, will call for bids at once.

The Board of Regents, Louisiana State University, Baton Rouge, La., will commence the erection of a new one-story engineering and mechanical shop and power house, 325 ft. long, with four 100-ft. wings, estimated to cost close to $180,000.

The Common Council, Haleyville, Ala., is arranging for the installation of a municipal electric power plant in conjunction with a waterworks system, estimated to cost $100,000.

The Georgetown Water, Gas, Power & Electric Co., Georgetown, Tex., has preliminary plans for rebuilding the portion of its power house recently destroyed by fire with loss estimated at $50,000.

The Southern Paper Co., Moss Point, Miss., will soon take bids for the erection of an addition, comprising a complete pulp and paper mill unit, increasing the output to 100 tons daily. George F. Hardy, 309 Broadway, New York, is consulting engineer and will be in charge of machinery proposals and installation. J. L. Dantzler is president.

The Common Council, De Quincy, La., has disposed of a bond issue of $120,000, the proceeds to be used for the installation of a municipal electric power plant and waterworks system.

The Birmingham Stove & Range Co., Birmingham, has tentative plans for extensions. The company recently increased its capital from $122,000 to $213,000. Bolling H. Jones is president.

Plans of New Companies

The Tacony Machine & Screw Co., Philadelphia, was recently incorporated with capital stock of $30,000, and is equipped to manufacture special machinery and machine parts, also all kinds of automatic and hand screw machine products. At present it has a building on lease, but is looking forward to building its own plant in the near future. Within a few weeks, the company will be in the market for machine equipment consisting of automatic and machine tools. The officers of the company are: Lewis Bessan, president; C. F. Klotz, 3408 Comly Street, Philadelphia, vice-president and treasurer; and W. L. McMillan, secretary. The company recently acquired the established business of the Victor Screw Machine Products Co.

The Werner Tool & Supply Co., 221 Fountain Street, Providence, R. I., has filed notice of organization to manufacture and deal in tools and mechanical equipment. Changes have not progressed far enough to warrant any statement regarding procedure, but the primal function for the present will be selling tools. J. O. Werner is manager.

The Beekman Stove & Furnace Co., 99 Beekman Street, New York, which was incorporated some time ago to manufacture stoves, furnaces, etc., will do no manufacturing for the present. It is built around a copartnership of the same name which has done business for three years as a jobber handling mainly ranges and oil heaters.

The Crude Oil Carburetor Co., Inc., 1104 Scott Avenue, Wichita Falls, Tex., is authorized in a recent charter to manufacture carburetors for oil field gas engines. Its present activities will be confined to this product, but in the near future it will have carburetors of other makes manufactured in the East or Central West by contract. The company's product is constructed entirely of steel in the form of a cylinder containing a cylinder. S. Walker is president.

The Timken Roller Bearing Service & Sales Co., which began its functions on Jan. 1, completes the program of the Timken Roller Bearing Co., Canton, Ohio, in following its products from the raw material through its steel, rolling and tube mills, located in three foreign countries and the United States, to the final market. The new branch will have entire supervision of sales through the 32 factory branches scattered throughout the country.

The S. F. Roofing Co., 1710 East Thirteenth Street, Brooklyn, N. Y., has been incorporated with capital stock of $25,000, and will manufacture roofing products. Actual operation will be delayed for some time, pending a decision upon a location and the extent to which activities will be projected. The management hopes to be doing business within a few months. The principals in the organization are: G. P. Neilsen and W. B. Grubb. Mr. Molloy of the firm, Wood, Molloy & France, 25 Broad Street, New York, is counsel.

The Acme Pump & Tank Corporation has been incorporated with nominal capital and will engage in manufacturing tanks, pumping equipment, etc. At least for the time being activities will be on a small scale. The incorporators are: R. D. Parker, A. C. Mandel and M. Shapiro. Berger & Hartmann, 217 Broadway, New York, represent the company.

S. S. Brees, Inc., Port Jefferson, N. Y., which recently was incorporated with capital stock of $50,000, is authorized by its charter to operate a shipbuilding and repair works. The new company is taking over the properties and business of the Port Jefferson Marine Corporation and will confine its activities for the present to building small craft and to repair work. Certain extensions are being worked out and it is expected that within a few months a new corporation affiliated with this one will be effected. The chief incorporators are: W. J. Barrett and S. M. Gordon. Counsel for the company is G. R. Gordon, 2 Rector Street, New York City.

The Wurldsbest Ventilator Co., 218 Pearl Street, Hartford, Conn., has filed a notice of organization and plans to manufacture ventilator equipment. However, no manufacturing will be done unless it is in the remote future, the present activities of the company being confined to acting as selling agent for other concerns. Charles W. King heads the company.

The Automatic Sprinkler Co. of America, Inc., 123 William Street, New York, recently incorporated through the Corporation Trust Co. of Delaware, Dover, Del., has taken over the business of the Automatic Sprinkler Co., of the same address, with factories at Youngstown, Ohio, and will engage in the manufacture of sprinkling systems and equipment for fire protection. For several years the company acquired manufactured fire protection devices including Manufacturers, International and Niagara systems; and during the war the business attained large proportions. Its capitalization is $4,000,000. Large quantities of pipe are used, most of which is taken care of through the Youngstown Machine & Tube Co. The incorporators are F. J. Moeckel, 1113 Hoe Avenue, New York; H. W. Roberts, Garden City, L. I., and A. J. Richards, Mountainview, N. J.

Phillip Sievering, Inc., 199 Lafayette Street, New York, has been incorporated with capital stock of $75,000, to operate an electro-plating works, particularly to serve manufacturers of ferrous products. It has taken over a business established for 35 years, and to cope with the growing business it has enlarged its floor space and expects to install additional equipment some time in February. The principal incorporator is Philip J. Sievering.

The London Lighting Equipment Co., New York, has been incorporated with capital stock of $25,000, to manufacture electrical fixtures and apparatus. Except for the organization of the management, activities will be suspended until February, at which time the company will act as distributor for a large manufacturing concern. The company, however, will do no manufacturing itself. The incorporators are: M. Kozinn, I. Bregoff, and B. Chess. Present business is being negotiated through Horace London, 302 Broadway, New York.

The Brightman Brothers Co., Columbus, Ohio, has been organized to manufacture bolts and nuts. The principals in interest are associated with the present Brightman Mfg. Co., Columbus, and the activities of the new company will doubtless be along the same line. Plans for production have not yet been consummated.

Electric Appliances, Inc., Muncie, Ind., an outgrowth of a purchase recently made of the Sterolectric Co., through a receiver, has been incorporated with capital stock of $50,000, to manufacture electrical heating and cooking devices. The factory is equipped and in operation, turning out various products, chief of which is a fireless automatic cooker. The incorporators are: C. G. Moore, vice-president The Moore Co., Muncie; R. A. Schuster and J. L. Moore.

William J. Sweet Foundry Co., Inc., 2527 East New York Street, Philadelphia, has been incorporated under New Jersey laws to produce Inco monel metal and nickel castings under the direction of W. J. Sweet, who was associated with the International Nickel Co. for over twelve years, and for the last two years has conducted an experimental foundry at Bayonne, N. J., in order to develop ideas in casting monel metal. These castings are now being produced in considerable quantities. In an effort to overcome difficulties encountered in casting this metal an electric furnace of the Repel-Arc type has been installed in addition to crucible furnaces. W. J. Sweet is president, H. A. Cooper, vice-president, and C. C. Bruno, secretary-treasurer.

Trade Changes

The Smith Gas Engineering Co., builders of clean gas producer plants, Dayton, Ohio, has recently appointed the Vincent-Gilson Engineering Co., 30 Church Street, New York, as Eastern representative and Harry Himelblau, Room 813, 179 West Washington Street, Chicago, as its representative in the Chicago territory. The company is experiencing a decided revival in business and has a great many interesting prospects for the next year. It is now building for the Ford Motor Co.'s Highland Park plant three 16-ft. mechanically operated clean gas producers which will add to the present capacity of the plant, which is the largest clean gas producer plant in the world. It is now making approximately 45,000,000 cu. ft. of clean gas per day and with the additional equipment will have a capacity of 60,000,000 cu. ft. per day. This gas is used for the development of power and for a great many industrial heating operations, such as forging, heat-treating, tempering, brazing, soldering and the like which are commonly found in the automobile industry.

The Standard Gear Co., 5928-38 Commonwealth Avenue, Detroit, has changed its location to 2821 Brooklyn Avenue, that city, where it has secured a more spacious and up-to-date plant.

The Accurate Tool Co., 570 Franklin Street, Detroit, has moved to 2270 Franklin Street, that city.

The Pittsburgh-Des Moines Steel Co., Curry Building, Pittsburgh, announces that on Jan. 1 Joseph S. Harrison will take the duties of advertising manager, I. A. Bickelhaupt, whose place he will take, will move temporarily to Richmond, Va., to organize a sales and construction office for the company. From the new office the entire Southeast, from Baltimore on the north and Birmingham on the south will be covered.

The Flexo Supply Co., National Bank of Commerce Building, St. Louis, has changed its address to 102 Merchants' Exchange, that city.

The Globe Steel Tubes Co., Milwaukee, announces the opening of a district sales office for the southeastern territory in Baltimore, Md., at 716 Continental Building. R. R. Lally, formerly with the National Tube Co., has been appointed district sales agent.

Current Metal Prices

On Small Lots, Delivered from Merchants' Stocks, New York City

The following quotations are made by New York City warehouses.

As there are many consumers whose requirements are not sufficiently heavy to warrant their placing orders with manufacturers for shipments in carload lots from mills, these prices are given for their convenience.

On a number of items the base price only is given, it being impossible to name every size.

The wholesale prices at which large lots are sold by manufacturers for direct shipment from mills are given in the market reports appearing in a preceding part of THE IRON AGE under the general heading of "Iron and Steel Markets" and "Non-ferrous Metals."

Iron and Soft Steel Bars and Shapes

Bars:	
Refined iron bars, base price	3.04c.
Swedish bars, base price	7.50c.
Soft steel bars, base price	3.04c.
Hoops, base price	4.39c.
Bands, base price	3.84c.
Beams and channels, angles and tees 3 in. x ¼ in. and larger, base	3.14c.
Channels, angles and tees under 3 in. x ¼ in., base	3.04c.

Merchant Steel

	Per Lb.
Tire, 1½ x ½ in. and larger	3.10c.
(Smooth finish, 1 to 2½ x ¼ in. and larger)	3.30c.
Toe-calk, ½ x ⅜ in. and larger	4.15c.
Cold-rolled strip, soft and quarter hard	6.75c. to 7.25c.
Open-hearth spring steel	4.00c. to 6.00c.
Shafting and Screw Stock:	
Rounds	3.90c.
Squares, flats and hex	4.40c.
Standard cast steel, base price	15.00c.
Extra cast steel	18.00c.
Special cast steel	23.00c.

Tank Plates—Steel

¼ in. and heavier	3.14c.

Sheets

Blue Annealed

	Per Lb.
No. 10	4.19c.
No. 12	4.24c.
No. 14	4.29c.
No. 16	4.39c.

Box Annealed—Black

	Soft Steel C. R. One Pass, Per Lb.	Blued Stove Pipe Sheet Per Lb.
Nos. 18 to 20	4.30c. to 4.55c.	.....
Nos. 22 and 24	4.35c. to 4.60c.	5.00c.
No. 26	4.40c. to 4.65c.	5.05c.
No. 28	4.50c. to 4.75c.	5.15c.
No. 30	4.75c. to 5.00c.	.....

No. 28 and lighter, 36 in. wide, 10c. higher.

Galvanized

	Per Lb.
No. 14	4.35c. to 4.60c.
No. 16	4.50c. to 4.75c.
Nos. 18 and 20	4.65c. to 4.90c.
Nos. 22 and 24	4.80c. to 5.05c.
No. 26	4.95c. to 5.20c.
No. 27	5.10c. to 5.35c.
No. 28	5.25c. to 5.50c.
No. 30	5.75c. to 6.00c.

No. 28 and lighter, 36 in. wide, 20c. higher.

Welded Pipe

Standard Steel	Black	Galv.	*Wrought Iron*	Black	Galv.
½ in. Butt	—50	—35	½ in. Butt	—11	+13
¾ in. Butt	—55	—42	¾ in. Butt	—17	— 1
1-3 in. Butt	—57	—44	1-1½ in. Butt	—20	— 2
2½-6 in. Lap.	—54	—41	2 in. Lap	—14	+ 2
7-8 in. Lap	—50	—26	2½-6 in. Lap.	—18	— 2
9-12 in. Lap	—46	—25	7-12 in. Lap	—10	+ 6

Steel Wire

BASE PRICE* ON No. 9 GAGE AND COARSER	Per Lb.
Bright basic	4.75c. to 5.00c.
Annealed soft	4.75c. to 5.00c.
Galvanized annealed	5.40c. to 5.65c.
Coppered basic	5.40c. to 5.65c.
Tinned soft Bessemer	6.40c. to 6.65c.

*Regular extras for lighter gage.

Brass Sheet, Rod, Tube and Wire

BASE PRICE

High brass sheet	20 c. to 21 c.
High brass wire	20½c. to 21½c.
Brass rods	17¼c. to 18¼c.
Brass tube, brazed	27 c. to 28 c.
Brass tube, seamless	23½c. to 24 c.
Copper tube, seamless	26½c. to 26¾c.

Copper Sheets

Sheet copper, hot rolled, 24 oz., 22½c. to 23½c. per lb. base.

Cold rolled, 14 oz. and heavier, 3c. per lb, advance over hot rolled.

Tin Plates

Bright Tin		Coke—14-20		
	Grade "AAA" Charcoal 14x20	Grade "A" Charcoal 14x20	Primes	Wasters
80 lb.			$5.80	$5.55
90 lb.			5.90	5.65
100 lb.			6.00	5.75
IC	$10.00	$8.50	6.15	5.90
IX	11.50	10.00	7.15	6.90
IXX	13.00	11.25	8.15	7.90
IXXX	14.25	12.50	9.15	8.90
IXXXX	16.00	14.00	10.15	9.90

Terne Plates

8-lb. coating, 14 x 20

100 lb.	$7.00
IC	7.25
IX	7.50
Fire door stock	9.00

Tin

Straits pig	41c.
Bar	45c. to 50c.

Copper

Lake ingot	15¼c.
Electrolytic	15 c.
Casting	14⅞c.

Spelter and Sheet Zinc

Western spelter	8¾c.
Sheet zinc, No. 9 base, casks	10¼c. open 10¾c.

Lead and Solder*

American pig lead	8c. to 8¾c.
Bar lead	9c. to 10c.
Solder, ½ and ½ guaranteed	28c.
No. 1 solder	26½c.
Refined solder	23¾c.

*Prices of solder indicated by private brand vary according to composition.

Babbitt Metal

Best grade, per lb	75c.
Commercial grade, per lb	35c.
Grade D, per lb	25c.

Antimony

Asiatic	7½c. to 8¼c.

Aluminum

No. 1 aluminum (guaranteed over 99 per cent pure), in ingots for remelting, per lb	25c. to 27c.

Old Metals

Business is quiet over the holidays, but values are firm. Dealers' buying prices are as follows:

	Cents Per Lb.
Copper, heavy crucible	12.50
Copper, heavy wire	12.00
Copper, light and bottoms	10.00
Brass, heavy	7.25
Brass, light	6.00
Heavy machine composition	9.50
No. 1 yellow brass turnings	7.50
No. 1 red brass or composition turnings	8.75
Lead, heavy	5.75
Lead, tea	4.50
Zinc	4.50